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# SCIENTIFIC AMERICAN

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The inclined tramway by which the mountain top, removed by steam shovels, is sent down to the mill.  
MOVING A MOUNTAIN IN UTAH.—[See page 281.]

## SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, OCTOBER 16th, 1909.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

EDUCATIONAL VALUE OF THE HUDSON-FULTON  
CELEBRATION.

In view of the considerable cost, exceeding \$1,000,000, of the Hudson-Fulton Celebration, the question has been raised as to whether any results have been realized, or could possibly be realized, that justify so great an outlay. If by results we are to understand any tangible commercial returns, it might be difficult to give a satisfactory answer; although it cannot be doubted that mine host of the inn and that innumerable army which caters to the physical well-being of a holiday crowd are more than satisfied.

To those of us who are in the habit of looking below the surface of things, and who ever bear in mind the transcendent importance of the spiritual and moral over the merely material, it will be evident that the mere outlay upon the recent festival is of minor importance compared with the valuable gain to New York city, the Hudson River district, and to the country at large, due to the close attention which that festival has directed to certain important events in the history of the United States, and the correcting of certain serious historical errors concerning them.

Thus, in view of the far-reaching importance of his discovery, it was well worth the cost and trouble of the celebration to abolish once and for all the mythical "Hendrik" Hudson, and have restored to the page of history the actual "Henry Hudson, Englishman," who sailed in a Dutch ship and under the Dutch flag after signing the recently discovered contract in which he is so named and thus designated. And it may be as well just here to explain that the total absence of the English flag from the elaborate scheme of decoration was perfectly proper, even in spite of the fact that it celebrated the feat of a British citizen. For the discovery of the river was made under the auspices of a Dutch company and by a ship which flew the blue, white, and orange, just as that other great event commemorated by the celebration, the inauguration of steamship travel, was achieved by a vessel which flew the American flag. Technically considered, the exclusive use of the old Netherland colors and of our national emblem was correct; and had the scheme of decorations been thrown open to include the flags of all nations, it would certainly have lost much of that distinctive character which was one of its successful features. Now that the historical facts as to the real name and nationality of Hudson have been presented in such convincing form to the world at large, it is to be hoped that the mistaken spelling of the name will be carefully avoided in the interests of historical accuracy.

The other important truth brought out by the recent festival is the true relation of Verrazzano and Henry Hudson to the discovery of the Hudson River. The name of Hudson has been given to the river by practically universal consent, because he was the first navigator to make a complete exploration of the river throughout its navigable length, and to leave behind him a careful record of what he saw and did. He did not himself claim, nor as far as we know has anyone claimed, that he was the discoverer of New York Bay, an honor which we think should rightly belong to Verrazzano. The document which gives the account of Verrazzano's visit to New York Bay leaves the impression that his time was spent in the bay, and that the river he mentioned may have been the Narrows. Certain it is that the fact that the water at the mouth of the Hudson, if he ever entered that stream, was completely salt, and that the tidal currents were as strong

in one direction as the other, must have given Verrazzano every reason to believe that he was at the mouth, not of a river, but of an arm of the sea. Verrazzano was a bold navigator, and his letter to Francis the First, describing his voyage, proves him to have been a close observer and capable of giving an entertaining description of what he saw. The genuineness of the letter, it is true, has been attacked; but the latest consensus of opinion among the historical authorities agrees to consider it as genuine.

For these reasons it is rather timely that the Italians of this city should have recently erected a monument to their fellow countryman, which will serve to connect his name with the famous harbor into which he sailed in 1524.

## EVOLUTION NOT REVOLUTION.

We have received so many requests for information about the widely discussed Melville-MacAlpine improvement in the marine steam turbine, and so many exaggerated statements have appeared in the public press as to the "revolutionary" character of this device, that we hasten to say the improvement is in no sense revolutionary, but is rather one important step in the evolution of the ideal marine turbine drive. Hitherto, the propeller has been placed on the same shaft as the rotor or rotating portion of the turbine. In the device which Westinghouse has built for Melville and MacAlpine, the propeller would be placed on a separate shaft from the turbine, and a reduction gear of five to one interposed between the shafts, thereby reducing the speed of the propeller to one-fifth that of the turbine.

Why is this improvement, supposing that in actual test at sea it proves to be as efficient as in the experimental tests, of such great importance? Why should not the turbine and propeller be upon the same shaft? Why should it be desirable to run one at a much higher speed than the other? The answer is that the steam turbine shows its best economy, consumes the least coal per horse-power, when it is run at high speed, whereas the propeller shows its best economy when it is run at a relatively low speed of revolution. This is true both of high-speed transatlantic steamships and slow-speed cargo boats. The propellers of the "Kaiser Wilhelm II," running at a speed of 85 to 90 revolutions per minute, show a propeller efficiency of from 60 to 65 per cent. The propellers of the "Lusitania," running on her trial trip at 180 revolutions per minute, showed a propeller efficiency of only 48 per cent. Had the "Lusitania" used larger propellers running at lower speed, the speed of the turbine would have been too low for efficiency, and results at the turbine end of the shaft would have been disastrous. On the other hand, had turbines been used on the "Lusitania" running at the high speed which gives a maximum turbine efficiency, the propeller efficiency would have been even less than the low figure of 48 per cent. The only way out of the dilemma was to use the present speed of 180 revolutions, which is too low for the best turbine results and too high for the best propeller results.

Now, what Melville and his coadjutors have done is to design a gear which is strong enough and runs with sufficient smoothness to transmit the great horse-power of a modern steam turbine without causing excessive loss by friction. When De Laval introduced the first practical steam turbine some fifteen years ago, he solved the problem by introducing long helical gear, which reduced the speed from the several thousand revolutions per minute of the turbine to the working speed which was required on the power shaft. Apparently, what has been done in the new device is to master the difficult problem of providing a helical gear with a certain power of automatic self-adjustment, which will enable it to transmit several thousand horse-power without serious wear or heavy loss through friction.

Henceforth, if the gear shows good results in service at sea, it will be possible to secure the same horse-power with smaller turbines running at high speed, and to design the propeller with strict reference to the size and speed of the ship and the securing of a maximum effective thrust. Economy will thus be effected at both ends of the shaft; the engine room will become smaller, engine weights less, and the space and weight thus saved can be put into cargo and passenger space, or, in a warship, into heavier armament and better protection.

## THE MOST POWERFUL NAVAL GUN.

In a certain respect big guns are like big battleships. At the time they are being built, it would seem that the limit of size and range had been reached; as indeed they have, for the time being. The progress toward improvement is so rapid, however, in these days, that hardly has one construction reached its supposed limit, before work is begun on another, bigger and better. A good illustration of this fact is had in the making of the largest and most powerful naval weapon in the world, namely, our new naval 14-inch breech-loading gun. This powerful weapon is nearing completion, and will be delivered to the Navy

Department by the middle of October, for official tests at the Indian Head proving grounds.

The penetration of the new 50-caliber 12-inch guns to be installed on the new 26,000-ton battleships of the "Arkansas" class is given, at 11 inches of Krupp steel at an extreme battle range of 9,000 yards. The thickness of the armor plate on the British battleship "Dreadnought" and her successors in the British navy is 11 inches at the maximum. This thickness of armor is being used on the new American warships now under construction. Up to the time of the construction of the 14-inch gun, the new American 12-inch gun, with its penetration of 11 inches of Krupp armor at 9,000 yards, was our most powerful gun. But that it has been greatly surpassed by the new piece is shown by the following figures:

The new 14-inch gun weighs nearly 64 tons, or 10 tons more than the 12-inch rifles built for the battleships "North Dakota" and "Delaware." Its total length is 53½ feet. The capacity of the powder chamber is 15,848 cubic inches, and it will require 365 pounds of smokeless powder to hurl the projectile of 1,400 pounds. After this huge shell is fired, it will travel a distance of 542 inches within the bore of the gun, and after leaving the muzzle it is good for a 25-mile flight. The range at which it would be fired in actual battle, however, would be about 9,000 yards, or five miles. The range of naval battles has trebled since the Spanish-American war, at which time 3,000 yards was the estimated range for a naval conflict, the guns being built accordingly. But now to outrange the "enemy" it has become necessary to build all American naval guns with a range of five miles.

The shell will leave the muzzle of the 14-inch gun at the rate of 2,600 feet per second, and its muzzle energy will be 65,606 foot-tons. This is 13,000 more foot-tons energy than that designed for the latest 12-inch weapon. So great is the penetrative power of this rifle that, when fired with a full charge, the projectile will penetrate 22.7 inches of the best Krupp steel armor plate at the muzzle, and at the range of 9,000 yards would pass right through a piece of armor 13 inches in thickness.

THE RECORD FLIGHTS OF ORVILLE AND WILBUR  
WRIGHT.

Almost simultaneously in Germany and in America Messrs. Orville and Wilbur Wright made two new records of an entirely different kind on the second and fourth instant. The first record was made by Orville Wright at Potsdam, Germany, on October 2nd. He first took Crown Prince Frederick William on a flight of 10 minutes' duration at about 4:30 in the afternoon. During this flight the machine was driven to an altitude of about sixty feet. The Crown Prince was greatly pleased, and he urged Mr. Wright to go higher. Soon after alighting, Orville Wright started out again by himself, and for fifteen minutes he kept steadily mounting in circles until the aeroplane was a tiny speck in the sky. After reaching the maximum height, which he estimated was about 500 meters (1,637 feet), he started in a swift descent. The machine came down at a terrific rate, and finally alighted safely about five minutes after it started the descent. Orville Wright said that the view he obtained was very similar to that he had when on board the Zeppelin airship, except that objects seemed smaller on account of his greater height. The height reached was not accurately measured, but from Wilbur Wright's statement to our editor that his aeroplane, if sent upward at its best speed, would probably ascend at the rate of three feet a second, it seems probable that Orville attained even a greater height than he believes himself to have reached.

The second record is that of Wilbur Wright, which was made about 10 A. M. on the morning of October 4th, when he started from Governor's Island and flew over the waters of New York Bay and above the North River to a point opposite Grant's Tomb. Circling around the British cruiser "Inflexible," he made the return trip close to the Jersey shore, at an elevation of only about seventy-five feet. On the upward journey he flew at a height of some two hundred feet, where he experienced considerable difficulty from the eddies and gusts of wind produced by the skyscrapers in the lower part of the city. A northeast wind of about twelve miles an hour velocity was blowing. On the return trip, the daring aviator kept on the other side of the river, and at a low elevation in order to avoid these gusts. The entire journey was made in 33 minutes and 33 seconds, the distance being about 19½ miles. This flight was not official, and Mr. Wright expected to repeat it in the afternoon. The weather conditions were ideal at 4 P. M., but just as he was about to start a cylinder blew off the motor, and effectively put the machine out of commission. As Mr. Curtiss had left the city the evening before after having made a short circular flight of a quarter of a mile, there was no more flying in connection with the Hudson-Fulton Celebration. Mr. Wright has already begun to teach two lieutenants to fly the government aeroplane.

## ENGINEERING.

Steel manufacture by the electric furnace is making good headway. At the present time there are in operation about 80 furnaces of the electric type, namely, 19 of the Hérault system, 14 of the Kjelling, 10 of the Stassano, and the same number of the Roechling-Rodenhauser and Girol, the other twenty-seven furnaces being of eight other systems.

During the Hudson-Fulton Celebration week, the Interborough Rapid Transit Company of this city carried in the course of one day 2,200,000 persons without accidents, blocks, or other detriment to its service. The traffic was about equally divided between the elevated roads and the subway. Considering the crowded condition, this is a truly marvelous feat of city transportation.

At last the Atlantic has been crossed by a steamship at a speed of over 26 knots an hour, the "Mauretania" on her last trip to the westward having covered the course from land to land in 4 days, 10 hours, and 51 minutes, at an average of 26.06 knots, reducing her last record trip to the westward by 44 minutes. Although she did not reach her highest previous day's run, she maintained a steady high speed on every day throughout the course.

The monthly report of the Acting Chairman of the Panama Canal to the Secretary of War, dated September 15th, states that during the month of August, the total amount of excavation done on the Panama Canal was 2,755,178 cubic yards, the average rainfall being 9.27 inches. From now on there may be a diminution in the totals of excavation, due to the fact that portions of the canal have been finished, and that as the excavation grows deeper, the number of shovels that can be employed will be reduced.

The tests which are about to be made of the new army 14-inch gun at Sandy Hook will be followed with close interest; for upon the success of this gun will depend the character of the future armament of our sea-coast defenses. The new piece weighs about the same as the present 12-inch gun, but fires a heavier projectile with lower velocity and a greater curve of trajectory. Its great advantage is that it can fire 250 to 300 rounds without serious erosion, as compared with the limit of 80 to 85 rounds for the 12-inch gun.

The Bath Iron Works are to be congratulated on the remarkable speed made by the new torpedo-boat destroyer "Reid" during her standardization trials on the Rockland mile course, when she reached a maximum speed for one mile of 34.55 knots. This is about a knot faster than the speed, which was itself a record for a torpedo-boat destroyer, of the "Flusser," which made over 33½ knots. The mean of the high-speed runs of the "Reid" was 33.75 knots, which is an eighth of a knot better than the average of the "Flusser." The shaft horse-power was 15,000.

The Japanese armored cruiser "Ibuki," which is equipped with the Curtis reversible turbine built by the Fore River Company, has recently undergone successful steaming trials in Japan. In the six-hour trial under full power, the steam chest pressure was 239 pounds, and the exhaust shell vacuum was 25.7 inches. At 250.5 revolutions per minute the brake horse-power was 27,142, and the water rate per brake horse-power was 15.03; corrected to contract conditions, it was 13.88 pounds. The "Ibuki" carries four 12-inch and eight 8-inch guns.

The consulting engineer appointed by the city to pass on the plans and safety of the new Manhattan Suspension Bridge, Mr. Ralph Modjeski, has found everything to be satisfactory. The main tower foundations are good and sufficient, and although the foundation of the anchorages could have been improved by driving inclined piles, the fact that careful observation for the past sixty days failed to reveal any appreciable movement, leads him to consider that the foundations are safe and sufficient. The structure has been carefully designed and well built and will be amply strong to carry the heaviest traffic, as well as any reasonable addition in the weight of properly regulated traffic that it may have to carry for many years to come.

One of the most important works connected with the Panama Canal is the spillway in the middle of the Gatun Dam for regulating the height of the water in the lake. Usually it is preferred to locate the spillway in a position more or less remote from the dam; but in the present case the existence at the center of the site of the dam of a hill, which provided a rock surface at about sea level, proved the deciding factor, and led to the choice of the present site. The spillway consists of a concrete dam, whose crest is to be built on the arc of a circle, with its face convex to the lake. The crest will be at 69 feet above sea level. Above this, and placed between thirteen concrete piers built at the crest of the dam, will be fourteen gates, whose tops, when they are closed, will be 87 feet above sea level. These gates will give absolute control of the lake level under all possible conditions.

## ELECTRICITY.

The Postmaster-General of the United Kingdom has secured for the government telegraphic system all the Marconi wireless telegraph stations in the British Isles.

A new combined electric lamp and shaving mirror has been produced, in which the reflector can be arranged to throw the light only upon the face below the eyes, no light falling upon the mirror or the eyes.

The British Antarctic expedition now in course of preparation will carry wireless telegraphic equipment sufficient to enable messages to be sent to New Zealand from the ship and from stations established at bases of supplies on land or ice.

The Russian crown steel works at Slatons in the Ural district have secured the right to manufacture steel electrically by a process owned by a German company and using induction furnaces. An electric plant will be immediately installed by the Siemens-Halske Company, and the product will be marketed directly.

The electrified suburban system of the New South Wales State Tramways at Sydney, N. S. W., showed a profit of \$357,000 for the year ending June 30th, 1908, after paying all working expenses and interest on capital, as compared with a net loss of \$15,500 a year for the steam lines owned by the State. This encouraging result will probably cause extensive electrification in Victoria and other adjoining States.

The Commonwealth Edison Company of Chicago has been most successful with its plan of introducing electric flatirons. Ten thousand 6-pound irons were distributed up to March last on loan for six months without charge. At the end of that period the used irons were offered for sale at a reduced rate to the users, most of whom were only too glad to retain the irons at so low a price, while the demand for used irons returned has been greater than the company can supply.

It is reported that a large wireless telegraph and telephone station is to be erected at the Omaha shops of the Union Pacific Railroad, where Dr. Frederick H. Millener will conduct wireless telegraph and telephone experiments. Dr. Millener hopes to develop wireless telephony to such an extent as to permit railroad officials to keep in touch with trains, and thus govern their movements from sixty to one hundred miles from Omaha. If the system is developed as he expects, it will be possible for passengers on moving trains to carry on telephonic conversation within a radius of one hundred miles of Omaha.

The rapid progress of aviation has caused attention to be drawn from a new direction to the dangers of atmospheric electricity. In an article in the *Elektrotechnische Zeitschrift* Mr. L. Zehnder discusses the danger to balloons and aeroplanes of electrical disturbances, and the methods of avoiding disastrous effects. He points out that the electrical conditions of the air are subject to great variations during thunder storms and that the atmospheric charges may change suddenly in sign. In clear weather an ordinary balloon without metal parts is not exposed to any danger so long as it floats in the air; but in the modern dirigibles much of the framework consists of conducting materials, which add to the danger. Also a balloon may be charged with electricity and a spark produced when contact with the ground is made, setting fire to the gas.

An ordinance was introduced at a meeting of the City Council of Chicago making it compulsory for all railroads operating within eight miles of the city hall to use electricity on their lines in place of steam. There is every prospect that this ordinance will be passed, as there appears to be considerable popular agitation in favor of it. The ordinance requires that within a year after its passage and publication, all railroads shall submit plans to the Commissioner of Public Works, and within six months after the plans and specifications have been approved they shall commence to electrify their roads. If this ordinance is passed, it will result in abating the smoke nuisance in Chicago to a large degree.

The long lead in hydro-electric work maintained by the Pacific coast, which, with exceptional natural advantages, was early in the field, is illustrated by the new power plant of the Great Western Power Company at Big Bend on the Feather River, Cal., the electrical equipment of which is described in the *Electrical World*. The penstocks are the largest ever built for so great a head, the turbines themselves are of record size, 18,000 horse-power per unit, and are operated by what is certainly a record head of water for any turbines, 525 feet. The transformers also are of record size, being three-phase units of 10,000 kilowatts capacity, with 100,000 volts on the high-tension side. Another big plant described in the same issue is that of the Grand Rapids-Muskegon Power Company, which is remarkable for its high voltage generation, 110,000 volts being the highest yet attempted, as well as for the simplicity of its arrangement.

## SCIENCE.

Dr. F. A. Cook has decided to submit to American scientific and geographic organizations duplicates of the proofs which are at the University of Copenhagen. A simultaneous announcement is to be made in Denmark and this country as to whether he had furnished adequate proof that he had reached the North Pole.

Ten grammes or about one-third of an ounce of radium chloride, equivalent to one gramme of pure radium, is the total output for eighteen months of the Joachimsthal mines. After the hospitals and scientific institutions have been supplied, the remainder will be offered for sale at \$75,000 a gramme, or 15½ grains.

Analysis of the natural gas coming from the Caucasus wells, which is used for heating purposes, was made by M. Meuschen as to the gas from the Bibi Eybat territory. He finds the following composition in per cent: Methane, 54.80; hydrogen, 13.58; saturated carbides, 1.20; nitrogen, 20.42; oxygen, 7; carbonic acid, 3. Another sample gave only 0.80 hydrogen, 60.0 methane, and 25 nitrogen, with the rest about the same.

In a recent issue of the *Astrophysical Journal* Mr. Walter S. Adams of the Mount Wilson Observatory station summarizes the results of a study of the Mount Wilson photographs of sun-spot spectra. A discussion of the various elements whose lines are strengthened or weakened in the spot spectrum indicates that the changes observed may be best accounted for on the basis of a reduced temperature in spots. A detailed study of the spectrum of iron furnishes especially strong evidence in this direction, and the weakening of the "enhanced" lines in the spot spectrum is also most simply explained on the same basis. The presence of the spectra of titanium oxide, magnesium hydride, and calcium hydride is sufficient to account for the greater part of the unknown fluting and band lines appearing in the spot spectrum. The discovery of the existence of a magnetic field in sun-spots by Mr. Hale provides a ready and sufficient explanation for the widening of large numbers of lines in the spot spectrum for which there is no marked change of intensity.

An apparatus for making enlarged tracings of sound-waves from a cylindrical graphophone record, the magnification ranging from 150 to 2,500 times, was described by F. Proctor Hall before the British Association. In the sound-waves two elements are distinguished, impulse and resonance, which are illustrated by waves from the cornet, violin, bugle, etc. Vocal waves are found in groups regularly repeated. Each group contains a single impulse from the vocal cords, together with one or more sets of resonance waves produced by vibrations of the air in the vocal tubes. Pitch is determined by the number of impulses per second—I. e., by the number of wave groups—and is not affected by the character of the waves within the groups. The vowel quality of vocal sounds is not perceptibly affected by the number or form of the resonance waves, but is dependent upon their periodicity. The rate of the resonance waves may be calculated from the length of the air-tubes upward from the vocal cords. The calculation shows, for example, that the sounds *m*, *n*, *ng*, all contain a resonance wave whose period is about 530. The mean rates found from measurements of the enlarged waves are for *m* 550, for *n* 535, for *ng* 580. The observed rate for the sound of *a* in the word "great" is 420, and for the sound of *a* in "mat" 770 waves per second.

Mr. Durand, United States Census Director, has made an appeal to farmers all over the country to assist him in securing accurate agricultural returns at the coming census. He trusts that farmers will keep or provide some sort of written record of their operations during the year 1909. Each person in charge of a farm will be asked to state the acreage and value of his farm—that is, the acreage and value of the land kept and cultivated by him; the area of land in his farm covered with woodland, and, finally, that which is utilized for specified farm purposes; the acreage quantity produced and value of each crop, including grains, hay, vegetables, fruits, cotton, tobacco, etc., raised on the farm in 1909; the number and value of all domestic animals, poultry and swarms of bees on the farm on April 15th, 1910. He will also be asked to state the number and kind of animals sold during 1909 and the receipts from such sales, the number purchased and the amount paid therefor, and also the number slaughtered for food, and the value of such animals. The census act provides that the information shall be used only for statistical purposes for which it is supplied. "No publication shall be made by the Census Office whereby the data furnished by any particular establishment can be identified, nor shall the Director of the Census permit any one other than the sworn employees of the Census Office to examine the individual reports." Furthermore, the information reported on the agricultural schedule will not be used as a basis of taxation or be communicated to any assessor.

**The Employment of Liquid Air and Carbon Dioxide in the Treatment of Diseases of the Skin.**

The lack of specific remedies for many diseases of the skin has caused a diligent search for new remedies more efficient or less disagreeable than those in common use. An epoch in dermatology was marked by the introduction of Roentgen rays, which exert a curative action in many cases of eczema attended with profuse exudation and intense itching, in psoriasis, and in many fungous diseases of the skin and hair. Cathode rays have proven beneficial in numerous cases of lupus and, quite recently, malignant tumors of the skin have been cured by these rays.

But in many cases treatment with rays failed to effect a definite cure, and the experiments with other physical and chemical agencies were resumed. An American physician tried liquid air and carbon dioxide and obtained more or less success in cases of tuberculous abscesses, moles, pimpls, and superficial cancer of the skin. The method of treatment is as follows: Cotton wool, wound tightly on the end of a rod, is dipped into the double-walled glass flask of liquid air and then pressed lightly on the affected part of the skin. The skin freezes and becomes inflamed and in from 10 to 20 days the morbid growth sloughs off.

But liquid air is expensive and it also acts too energetically. An equally efficient, but cheaper and more manageable agent is carbon dioxide, which was first employed for this purpose by Pusey. From the steel cylinder which contains liquefied carbon dioxide, the vapor is allowed to escape into a glass tube. Here it condenses into snow, which is compressed by a piston into a hard mass. This can be trimmed to the size and shape of the morbid growth to which it is to be applied, and thus the freezing of the surrounding healthy skin can be avoided.

The temperature of carbon dioxide snow is  $-130$  deg. F., while that of liquid air is about  $-290$  deg. F. The snow is cold enough, however, to freeze the skin into a hard, white mass in a few minutes. Too long an application may cause necrosis, or death, of the underlying tissues. The skin subsequently becomes slightly inflamed and a blister, similar to that caused by a burn, is produced. In general, freezing and burning produce similar effects on the skin. In two or three weeks the part that has been frozen falls off as a scab, revealing skin of quite normal appearance or marked by a slight scar. The application of this remedy is not attended with great pain. In the treatment of facial blemishes especial care must be taken not to freeze the skin too deeply. The field of application of carbon dioxide snow is extensive. Hitherto good results have been obtained chiefly in cases of lupus, but small tumors, callosities, moles, pimpls, etc., have also been treated with success.—Dr. Berg-rath in *Die Umschau*.

**CYCLING TRICK IN A BERLIN VARIETY THEATER.**

The accompanying illustrations picture a trick performance which recently attracted much attention in Germany. In the first photograph a cyclist is shown traveling outside a globular cage on a narrow wooden path. He uses an ordinary bicycle wheel of 28 inches diameter, and that of the globe is ten times as great, viz., 280 inches. The circumference is consequently 280  $\times$   $\pi$  = 873.6, or roughly 880 inches. The globe is rotated by the friction of the cycle wheel on the top. Every minute it makes 30 revolutions, or 1,800 in one hour. Any point of the equator travels a path equal to 880 times 1,800 in one hour, or 1,584,000 inches. 1,584,000 As one mile is 63,360 inches, it means that

63,360

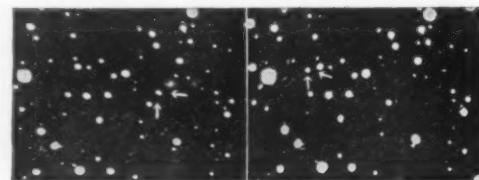
$\frac{1,584,000}{63,360} = 25$  miles are covered in one hour. The cyclist must be very careful to keep in the center of the path. By far the greatest difficulty lies in the fact that his

weight constantly draws him down the slope in front as well as backward. In other words, he must not only keep his balance right and left, but also forward and backward. The latter feat he accomplishes by accelerating or retarding his bicycle.

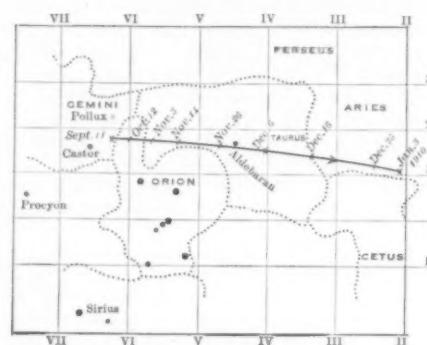
The other photograph shows two men inside the cage. They rotate the globe through the frictional contact of their wheels with the globe.

**THE FIRST PHOTOGRAPH OF HALLEY'S COMET.**

The accompanying photographs of Halley's comet were printed from negatives made with the Yerkes two-foot reflector by Mr. Oliver J. Lee on the nights of September 24th and September 26th, astronomical, or



In this photograph of Halley's comet the arrows indicate the position of the comet. At present the comet can be seen only through a powerful telescope.



The path of Halley's comet from the date of its discovery to January, 1910.

**THE FIRST PHOTOGRAPH OF HALLEY'S COMET.**

on the early mornings of September 25th and 27th, civil. The photographs are here published by permission of the director of the Yerkes Observatory, editor of the Astrophysical Journal, in the October number of which magazine these pictures are appearing, together with photographs taken on other dates. On September 24th the exposure was from 13h. 12m. to 15h. 42m. central standard time; on September 26th, from 14h. 47m. to 15h. 47m. central standard time. The arrows

shown on the original plate are about twenty-five thousand times as faint as a sixth-magnitude star, the limit of naked-eye visibility. The comet's motion in the sky at this time is comparatively slight, and will be very much greater later. The comet was "retrograding," or going westward, at this time, as seen from the earth (to whose motion this retrogression was wholly due), having ceased its eastward motion a few days before.

The comet has been micrometrically observed on several nights with the forty-inch Yerkes telescope by Profs. Burnham and Barnard. On the 26th it was estimated by Prof. Barnard to be of magnitude 14 or 14.5, with a diameter measured as 10 sec., but without definite boundary. The presence of strong moonlight is likely to prevent the observation of the comet, either visually or photographically, for several nights after September 27th.

**A HIGH SCHOOL OF AERIAL NAVIGATION IN FRANCE.**

It is due to the energetic efforts of Commander Rocher, who has succeeded in enlisting the assistance of a committee, the members of which are all well known in the scientific world, that a special high school of aerial navigation has been organized in France on the following basis:

1. All former students of the polytechnical schools, the schools of bridges and highways and mining engineering and of naval construction will be admitted as a matter of course. Graduates of science (in general physics and mechanics) will be admitted upon passing examination in the drawing of machines. Other places will be awarded upon open competition.

2. The course of instruction comprises one scholastic year.

3. The principal courses of instruction will be in all branches of aerial navigation, aerostatics, and aviation, and about motors, especially gas motors. The annual lectures about the various topics are arranged in such a way that the students will be kept posted about all evolutions in aerial navigation and of the sciences relating to it.

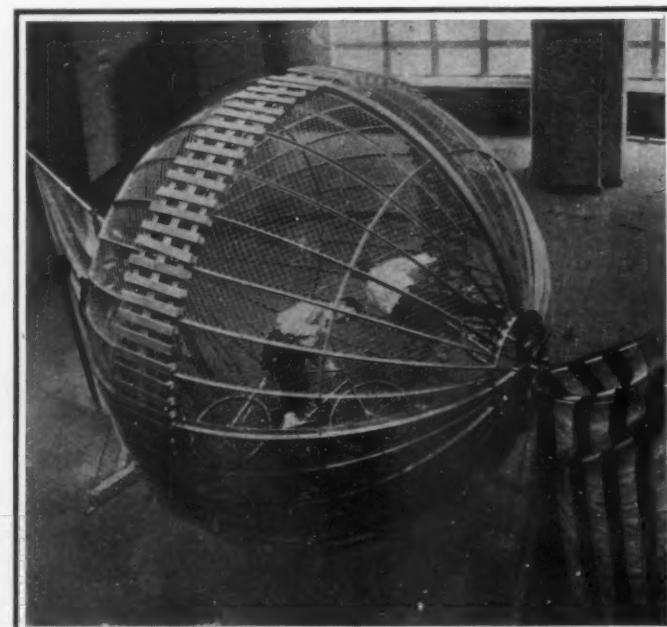
4. Independent of these courses of instruction, the students will have to execute practical work relative to aerial navigation and to motors.

5. To students who have completed all the courses as well as the technical work, and have successfully passed the examinations, the diploma of engineer of aerial navigation shall be awarded.

6. Besides the regular students, any person may attend one or several courses, without, however, participating in the technical work and without being entitled to examinations or to the award of the diploma.

7. The tuition fee for regular students is \$200. The fees for other persons vary, according to the number and the importance of the courses which they desire to attend.

It seems only logical that France, having been the first country to promote aerial navigation, shall also be the first one to organize a higher course of instruction in the same on a thorough and rational basis.



THESE TWO ILLUSTRATIONS REPRESENT A REMARKABLE BICYCLE TRICK WHICH ATTRACTED CONSIDERABLE ATTENTION IN GERMANY. A GLOBULAR CAGE 280 INCHES IN DIAMETER IS FRICTIONALLY ROTATED AT HIGH SPEED BY AN ORDINARY BICYCLE.

point to the comet, which is slightly elongated on the 24th, due to the motion of the comet during a two and one-half hours' exposure. The picture is much enlarged, and the stars shown are actually very faint, none of them visible to the naked eye. The brightest star in the field, at the left of the comet on each day, is of magnitude 8.7, or about ten times fainter than the faintest star that can be seen with the naked eye without a telescope on a clear night. The faintest stars

at the station site, a distance of 32,000 feet, and turbines of 21,600 horse-power capacity. The generators will consist of three 4,000-kilowatt turbine units, two 250-kilowatt excitors, and there will be three 4,000-kilowatt transformers. A transmission line 27 miles long to Montreal will be constructed, with transformer substations and distribution system there. The present developments are expected to cost \$4,000,000, the contract being let on the cost plus commission basis.

## SAVING THE AMERICAN LOBSTER.

BY F. HARVEY MIDDLETON.

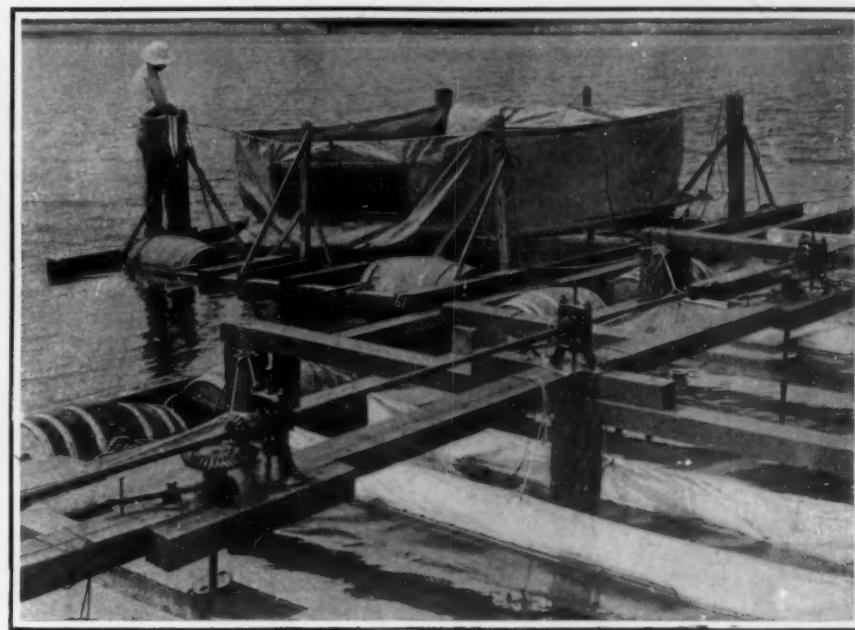
The little town of Wickford, Rhode Island, is the home of a most important and successful fish culture station. Here is situated a hatchery that has demonstrated the possibility of saving the lobster from the fate of absolute extermination. The conservation of

the lobster is devoured with equal impartiality by the plebian herring and the aristocratic bluefish. For a time the minute translucent creature, born with a voracious appetite, ekes out a precarious existence on the microscopic organisms of the sea, together with hundreds of its brothers and sisters born at the same time. As in our own world, so it is in the lobster

in the twilight, and being most active after dark. His natural home is in the cracks and crevices of the most rocky shores, and he seldom ventures forth except in search of food, which is dragged back to his retreat. The stronger the light the more cautious he becomes, and the daintiest morsel of chopped clam—his favorite dish—will not tempt him into the light



Cylinders in which individual lobsters are confined for observation.



Drying a 12-foot lobster bag after it has been washed.

this favorite crustacean has been a perplexing problem for many years both in America and Europe. Even Japan has recently taken a keen interest in the subject. Until the last few years the most earnest efforts to propagate lobsters artificially have failed to offset the ravages of their enemies of the deep, to say nothing of the onslaughts of man. The steady decline of the lobster fishery emphasized the urgent need of more scientific methods.

From the moment it breaks the egg membrane and emerges into the outer world, the tiny lobsterling is at the mercy of every swimming thing—a choice deli-

kingdom. The more active get the most food, and grow bigger and stronger than the less nimble. And as soon as he realizes his superiority, the larger lobster immediately starts devouring his smaller brethren. Settling to the bottom of the water, he will calmly seize the one nearest, quite indifferent whether it is a near relative or merely a chance acquaintance. The cannibalism of the baby lobster has always been the greatest impediment to the success of lobster culture.

But, confirmed cannibal though he is, the lobster is nevertheless a timid, nervous creature, thriving only

of day. If exposed to the sun, he will wander nervously about until he finds a dark spot.

A few years ago a little houseboat laboratory was started in the harbor of Wickford under the joint auspices of Brown University and the State of Rhode Island, with the object of studying every phase of lobster life. After numerous experiments Prof. A. D. Mead, who was in charge, came to the conclusion that the secret of success in rearing the young lobsters was to keep the water in continuous motion, thus preventing the little creatures from catching and swallowing one another. This also kept the food in suspen-



1. Lobsters in first stage of their development, at which time they are one day old.

2. Lobsters in second stage, having molted their skin once. Four days old.

3. Lobsters in third stage of their development, about eight days old.

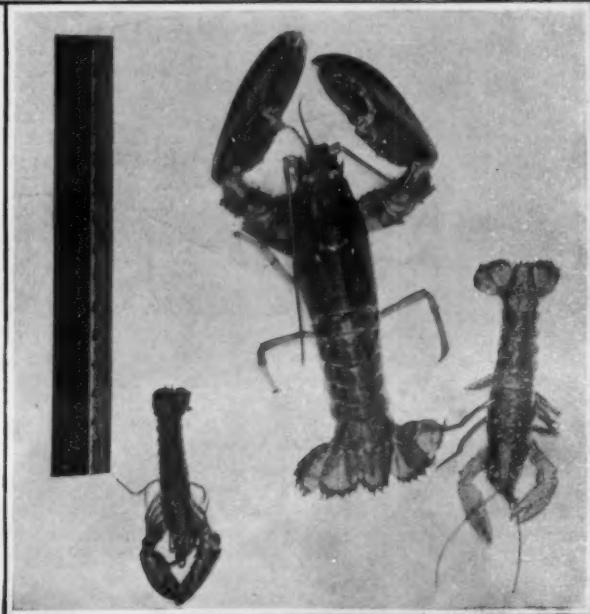
4. Lobsters in fourth stage, having molted three times. About two weeks old.

5. Lobsters in the fifth and sixth stages of their development.

6. Lobster in the seventh stage of his development.

7. Lobster seven weeks old, at which time he becomes recognizable.

The seven ages of a lobster. The photographs are all life size.



This lobster traveled ten miles in eight days. The copper tag attached asks the finder to return it.

An adult female lobster in "berry," or bearing egg clusters under the tail.

Three young lobsters of the same age, showing the great difference in growth.

sion, so that the fry might obtain it. Simple as this solution of the problem was, no one had ever thought of it before.

To prove the correctness of this theory, it was decided to experiment with the lobsters, which were at that time in small bags. The water in the bags was stirred with an oar continuously for six days and nights. The result was a brilliant success. The evident efficiency of this crude method of stirring in maintaining the life of the young fry naturally suggested a mechanical contrivance for protecting the fry during the extremely critical period of their early life.

Consequently, a series of bags 12 feet square and 5 feet deep was sunk into the water and tied securely in place. In each bag near the bottom was placed a two-bladed rotating fan, resembling that commonly in use over restaurant tables. These fans or propellers were connected with vertical shafts, which in turn were geared to a gasoline engine. When the machinery was set in motion, the rotation of the fans created a continuous current of water directed upward from the bottom of the bags, the force of the current being readily controlled by altering the angle of the blades. This also prevented the accumulation of parasites on the young lobster's body.

Scientists will tell you that from 30,000 new-born larvae, which represent the average total mass of the brood produced by one pair of lobsters during their lifetime, only one pair of mature lobsters are alive after a lapse of seven to nine years. The lobster fishermen have been at their wits' end to supply the ever-increasing demand of hotel and restaurant for this popular sea food. Now it bids fair to become so plentiful as to be within the reach of the humblest purse.

Before the installation of the stirring device at Wickford, it was the custom to turn out the young fry soon after hatching. But the young lobster at birth is as helpless as a human baby, with only feeble means of locomotion and no defensive weapons. There are many stages in the life of a lobster, at each of which he sheds his skin or shell and grows another. It is not until the fourth stage that he assumes the familiar form of the lobster, and is able to defend himself to a certain extent.

A successful effort was made to hatch the lobster eggs with the same stirring apparatus. Female lobsters were obtained from Newport, and the eggs were combed off in the ordinary manner, and placed in the stirring bags. When the propellers were set in motion these eggs were gently swirled about, and hatched into very beautiful young lobsters.

During the first three stages the lobsters swim near the surface in an aimless jerky way that reminds one of a wiggle-tail. The first stage lasts about three days, the second about four or five days, and the third usually about five or six days. From nine to sixteen days are required for the larvae to pass from the first to the fourth stage.

A most marvelous change of form, and an even more astonishing change of habits, occurs at the third molt. The emerging fourth-stage lobster has the general form of the adult. The abdomen is no longer bent down at right angles to the body, but, as in the adult, extends straight behind. The downward stroke of abdomen, which was the chief means of motion during larval life, is now used, as in the adult, only for rapid retreat. All five pairs of walking legs have lost their upper branches, and the first pair, which are now the large characteristic "nippers," are extended straight in front of the head while the lobster is swimming. These structural changes are accompanied by more radical changes, in habits and instincts. The lobster, no longer helpless upon the bottom, burrows under shells or stones and picks out a home, from which it sallies forth in search of prey. In shedding its third skin it has cast off all its previous timidity, and with its strong crushing claw is ready to defend itself against all comers.

A new style of swimming, which lasts only a week or two, is now adopted. The tail being extended straight behind the body, and the large claws extended in front of the head, the lobster swims forward in a perfectly straight and definite course by the strokes of the "swimmerets." No trace of its former aimless activity remains, for the lobster now actively seeks food, avoids enemies, and retreats from danger. The active but careless and helpless infancy has been succeeded by enterprising independent youth. The fourth-stage lobster has passed the most critical period of its entire life, and is vastly better fitted for the struggle for existence than at any earlier stage.

In the first molts, as in the succeeding ones, the process is the same, the old skin being split across the back, between the thorax and the abdomen, and the body working out through this opening, leaving the cast-off skin otherwise intact. The actual process of molting occupies only a few minutes, but occasionally something goes wrong, and the struggle is quite prolonged. Often the lobster dies in the process, and the period of molting is at best a very precarious one.

Last year 294,896 lobsters of the fourth stage,

counted singly after being taken out of the hatching bags with a tea strainer, were liberated in various places along the shores of Narragansett Bay. These thousands of lobsters have more value for the improvement of the local lobster stations than as many millions of larvae of the first stage, with the setting free of which the experiment stations had previously to be satisfied. But even after the lobsters have been reared to the fourth stage their future chances of life depend, in some degree, on the time and place and manner of their liberation. Thus far it has seemed best to liberate them in the morning, so that they may find hiding places and settle themselves before night falls, and to scatter them over a considerable extent of territory, so that they may not gather in a conspicuous swarm.

For years the United States Fish Commission has hatched at Woods Hole, Gloucester, and at other stations, many millions of eggs annually, and have set free the young as soon as possible after they were hatched. But in this case the fry are distributed in deep water, and are thus in less danger from their natural enemies, which, like the mummichog and the shrimp, abound in shallow water. The apparatus used in hatching at Woods Hole is the McDonald Jar, into which the eggs are placed immediately after they are "combed" from the females. In this they are kept swirling sometimes for weeks by a constant stream of salt water.

The lobster ranges from Labrador to Delaware, and inhabits the waters from the very shore to a depth of more than one hundred fathoms. It is thus confined to a strip of the Atlantic Ocean about 1,300 miles long, and at some points, as the coast of Maine, from 30 to upward of 50 miles wide. The number of eggs or "seed" carried by the female on the under surface of her tail varies from 10,000 to 20,000.

At Wickford the young lobsters are raised from the egg to maturity, in order to determine not only their habits and requirements at various stages and in various seasons, but to ascertain as nearly as possible the normal rate of growth. When the fourth stage is reached, a number of lobsters are put into cars provided with sand, gravel, and seaweed, to stimulate as closely as possible the natural environment. The sides of the cars are made of galvanized iron screening, which allows a free circulation of water.

During the summer the cars are suspended from the house-boat, or from floats, so that the water in them is about eighteen inches deep. In the fall they are provided with tight-fitting covers, and sunk in the channel in from eight to ten feet of water, and left undisturbed until spring. The lobsters are frequently fed during the summer on chopped clams, fish, and several other varieties of food, but in the winter no food is given them, although they may obtain some food from the water or from the animal organisms which grow in the car. The cars seem to furnish a natural environment, for not only are the lobsters in a healthy condition, but seaweed, oysters, clams, mussels, shrimp, tunicates, barnacles, various specimens of marine worms and other animals grow inside of the cars as rapidly and normally as in other places.

An interesting part of the work at Wickford is the liberating of a number of lobsters with copper tags attached to them. Last summer 210 were set free with tags bearing a number and the words "Return to the Rhode Island Fish Commission." Thirty-six of the tags were returned by lobstermen with the date and place of capture, and valuable information on the movements of the lobsters was thus obtained. Although the greater number returned had not wandered far, some had made their way southward for several miles. The lobster bearing the tag "75," shown in the photograph, which was caught one mile southwest of Beaver Tail, holds the record up to date for fast travelling, having covered a distance of ten statute miles in less than eight days.

#### Official Meteorological Summary, New York, N. Y., September, 1909.

Atmospheric pressure: Highest, 30.48; lowest, 29.81; mean, 30.10. Temperature: Highest, 79; date, 3rd; lowest, 48; date, 29th; mean of warmest day, 74; date, 23rd; coldest day, 58; date, 28th and 29th; mean of maximum for the month, 72.2; mean of minimum, 59; absolute mean, 65.6; normal, 66.4; deficiency compared with mean of 39 years, 0.8. Warmest mean temperature of September, 72, in 1881; coldest mean, 61, in 1871. Absolute maximum and minimum of September for 39 years, 100 and 40. Average daily excess since January 1st, 1.1. Precipitation: 2.66; greatest in 24 hours, 0.83; date, 27th and 28th; average for September for 39 years, 3.61. Accumulated deficiency since January 1st, 0.95. Greatest precipitation, 14.51, in 1882; least, 0.15, in 1884. Wind: Prevailing direction, northwest; total movement, 7,335 miles; average hourly velocity, 10.2; maximum velocity, 45 miles per hour. Weather: Clear days, 10; partly cloudy, 9; cloudy, 11; on which 0.01 inch or more of precipitation occurred, 7. Frost: Light, 29th.

## Correspondence.

### THE FLOORS OF PANAMA LOCKS.

To the Editor of the SCIENTIFIC AMERICAN:

I notice in your last week's issue an interesting description of a plan for anchoring down floors of locks in the Panama Canal, to prevent lifting and injury by upward pressure of seepage water.

As an unbiased bystander, "watching the game," I venture to suggest that any possible pressure of the kind feared could be easily relieved by providing small openings at intervals in the floors of locks, with steel tubes extending vertically from upper to lower surfaces, with valves which could be opened to allow seepage water to flow into locks freely during inspection.

Such safety valves could be inserted with very much less expense than anchorages proposed. Would some of your readers interested in hydrostatics kindly point out any practical objections there might be to such a procedure?

R. ARMSTRONG.

### THE NUMBER OF OUR ANCESTORS.

To the Editor of the SCIENTIFIC AMERICAN:

Will Mr. Solon De Leon kindly give us his authority for his "consanguine groups"? The more the habits and customs of primitive peoples are studied, the more it becomes apparent, I believe, that they have, and had, strict rules preventive of all close interbreeding. I am not in a position to name authorities, but have just been reading John Rhys's "Studies in the Arthurian Legend," in which, referring to such matters, he says: "Celtic mythology fails to carry us back to a state of society where it could have been possible." (See page 227.) Mr. Eckles's isolated communities were bad enough, but now we have Mr. De Leon's family groups, all the daughters of which were wives of all the sons; yet science is emphatic in teaching that all inbreeding, whether of plants, animals, or man, is fatal, and leads to the degeneration and extinction of the race. And Nature confirms the same. These gentlemen greatly exaggerate the conditions, I think, or surely we should all have vanished off the scene centuries ago! If "consanguine groups" ever existed, it must have been in the very infancy of the race, and certainly could not be placed within the last 25,000 or 30,000 years.

Should it be true that it is next to impossible to find any two Englishmen who have not an innumerable number of ancestors in common, then it can only be a question of time when the same truth would apply to all human beings. We are told that everything is possible in this wonderful world except logical contradictions; are not these theories a fair example of such? Isolated and consanguine groups would tend to keep the general population separate, and so cut both ways. In any case, the problem as given in my last letter in your issue of September 11th remains unaffected. Such a case of intermarrying as F. W. A. specifies must surely be very rare indeed!

Doubtless the intermarrying of relatives explains much of the puzzle, but it will not bear all the weight some of your correspondents are willing to risk upon it.

Los Angeles, Cal.

A. K. VENNING.

### The Current Supplement.

Just now the popular conception of Fulton is that of a man who invented steam navigation. A critical consideration of what he really did is presented in the current SUPPLEMENT, No. 1763. The very high power which is now demanded of naval ordnance, especially the main armament of battleships, has led generally to a consideration of the utmost importance—the life of the guns. This question will be found admirably discussed in a thorough article. Well-equipped experimental laboratories are indispensably necessary for the progress of aviation. One of these is the Aerodynamic Institute of Kuchino, which is well illustrated and well described. Steam turbines may be governed in several ways, which are considered in a carefully prepared article. The admirable *résumé* of importance in the internal-combustion engine begun in a recent number by Mr. H. E. Wimperis is continued. The old dusty road that winds from the landing of the village of Capri to the mountain top behind the village will no longer be used by the tourist. A cable railway now takes its place. This railway is described and illustrated. E. Sherwald writes on some decorative designs derived from the polarization figures of quickly-cooled glass. Prof. L. Jaloustre contributes a simply worded article on catalysis. G. Espitalier discusses building methods in the earthquake regions. The makers of arc lamps have several times devised more or less ingenious lamps, in which the clockwork or motor by which the carbons are moved as they are consumed is suppressed. Most recent attempts of this kind are to be found in the Beck arc lamp, which is described in the SUPPLEMENT. Oliver Light contributes a suggestive article on the making of automobile repairs.

STRANGE SCIENTIFIC ANOMALIES AT THE NORTH POLE.  
BY JAMES ARTHUR.

In the illustration, Fig. 1, *N S* is the earth's axis, on which it rotates, *with reference to the sun*, in 24 hours of *mean* or clock time. This axis is purely imaginary; yet the fixity of its position is one of the fundamental facts in astronomy. The same remark applies to the earth's rotation on this imaginary axis. When we remember that the earth is nearly as heavy as a ball of iron, and that the surface velocity at the equator is about 17 miles per minute, we can form some conception of this uniformity. Mathematicians lead us to conclude that this rotation and its axis, or center line of motion, are not eternal and that they will change; but for the historic period we may consider them uniform and permanent. Finally, they are the nearest to absolute uniformity and fixity that we know of. A minute slowing of the rotation would not disturb anything, beyond keeping the astronomers busy correcting their tables, including those of our erratic neighbor, the moon.

Did you ever think what would happen if the axis of rotation changed a little? The polar diameter of the earth is about 26 miles shorter than the equatorial diameter; therefore each pole is "flattened" 13 miles; so the section of the earth, if split through the plane of a meridian, would be elliptical. Remember, this is the *sea level* form of the earth. Now let us suppose the axis to be changed so as to *reduce* the latitude of New York by bringing the new equator nearer to the city. The city would then be covered by the waters of the Atlantic and the land near the new poles would be left high and dry. That is, the ocean level would *rise* on New York and *fall* at the new polar region. On this assumption—that the axis could be changed on the meridian plane of New York—two very interesting and impressive questions arise.

1st. What diminution of latitude would raise the waters of New York Bay one thousand feet, and thus cover the city with Atlantic water?

2nd. What increase of latitude would lower the waters of the bay forty feet, and leave all New York docks simply mud holes?

Clearly it is perilous to disturb the earth's axis.

Refer to Fig. 1, where the sun *A* is shown on the *line* at the spring equinox. An observer on the equator at *E* would see the sun on the celestial equator just where he is; that is, half his face on each side of the celestial equator. An observer at the North Pole *N* would see the sun the breadth of his face higher at *B* than his real position *A*. An observer at *S* would see him at *C*. This is caused by the refraction of the sun's rays in passing through the atmosphere; and it is a remarkable fact that the average amount of this refraction, at the horizon, is just about the breadth of the sun's face, so that the three suns seen by the observers *N E S* would touch one another as shown.

Now let us assume level land within the Arctic circle and that we have built an astronomical observatory on the pole. To make things balance, let the observatory be built in the form of an Irish "round tower." How would we know the location of the pole so that we could build an observatory on it? "Oh," you say, "that would be easy. Just build it plumb under the pole star." Not at all. If we did that, we would be about 85 miles from the pole. The reason of this is that the so-called "pole star" is only the nearest bright star to the "polar point." This popular pole star makes a daily circle around the "polar point" about  $4\frac{1}{2}$  times as broad as the sun's face, and we must make the sharp cone of our round tower point to the center of this circle. Then we would have a "pole" worth speaking about.

Sitting in the top of this tower what would you see? The sun sweeping around the horizon once in 24 hours, but a little higher each day in a grand spiral course in the celestial sphere, as compared with the horizon. In a little over three months he would be above the horizon  $23\frac{1}{2}$  degrees, and this would be the middle of the "great day"—and the longest day at New York.

We are now in a position to make some wonderful and unusual experiments and observations. One of the delicate experiments would be to determine the length of a pendulum beating seconds at the pole. This would enable the mathematicians to correct their figures as to the form and density of the earth, two matters of great astronomical importance. In this observatory we would determine any meridian such as Greenwich and get its local time as easily as in any observatory south. Now stand with your back to the pole (round tower) facing south on the "first meridian" and walk down this meridian a little over three and one-half miles till you come to a circle of latitude 24 miles in circumference *G*, Fig. 2. Now face west with your right hand to the pole, and stand there till your shadow points straight to the pole. This would be noon at Greenwich. Start walking due west on the circle *G M* at the rate of one mile per hour. As you walk what changes would you see? None whatever; for your shadow would steadily point to the North

Pole (round tower) and the sun would appear to stand still in the sky. You could see only the motion of your feet over the ground. What were you doing during this 24-hour walk? With respect to the sun you were not moving; but simply *treading the ground* with your feet. On this 24-mile circle of latitude you were walking one mile an hour *west*; but as the earth rotates one mile an hour *east* on this circle you were just neutralizing its motion and making no headway with reference to the sun. Let us now go out to a circle of latitude of 48 miles circumference *O P*, and on each of the 24 meridians here draw a circle two miles diameter. These circles would just touch one another, as shown on Fig. 2. Set up a flagstaff in the center of each of these circles. Divide each circle into 24 hours, marking 12 on the meridian, on the side of each circle toward the pole. Only the Greenwich and New York dials are divided in this illustration. You have now 24 sundials, each one giving the local time of its meridian, and it would be *noon* on each meridian when the shadow of the staff pointed straight to the round tower on the pole. Now consider the shadow of our round tower observatory at Greenwich noon



Fig. 1.—APPARENT POSITION OF THE SUN AT THE EQUATOR AND AT THE POLES.

when the staff shadow points to the pole on the meridian of zero; then the shadow of the sharp tip of the tower would fall on meridian 180 degrees and indicate midnight, or 24 o'clock on that meridian, and so for all other meridians. We would thus have *noon* and *midnight* on each of the 24 meridians every day. These 24 dials would read, consecutively, one hour apart. This 180th meridian is the theoretical "date line," or beginning and ending of a date. Since a day is always beginning and ending at the 180th meridian, you could walk from to-day into to-morrow or from to-day into yesterday as often as you pleased. But if you sat in the center of the observatory, on the pole, you would have all times in the 24 hours and no particular time. No local time—no north, east, or west. You could move only south, at the first move. Your parallel of latitude would be a point. Your meridian would be all the meridians—and none of them! Any wind passing over the pole would blow from the south and also *toward* the south at the same time. If you tried to go farther north, you would be going south.

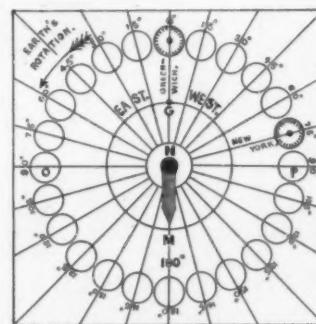


Fig. 2.—DIAGRAM ILLUSTRATING ANOMALIES OF TIME AT THE POLE.

These suppositions have been made for about the middle of the great polar day; but this day is worthy of some attention. Probably you suppose that it means simply six months day and six months night. You are wrong. As shown above, in connection with refraction the sun at the spring equinox is clear above the horizon and the same at the autumnal equinox, as shown in Fig. 1. If you will add to this refraction, the slight dip of the horizon, as seen from the tower observatory, and also a few days of twilight morning and evening of the "great day," you will have several days more than half a year. But this is not all; for the sun is almost four days more than half a year above the celestial equator; that is, four days longer than half a year between the spring and autumnal equinoxes. All these lengthen the "great day"; so that it would be a good practical working day of about seven months. Remembering our assumption of *level land* and clear weather in the polar region, the apparent motion of the sun would be wonderful. He would appear simply to rise straight up and then down; but his daily course *around* could be observed only by shadows, or from the observatory; so that in the open, for a short period, he would appear absolutely fixed in the celestial sphere.

How would the moon behave? During the great day

she would be only above the horizon along with the sun, and show only *third quarter*—dark—*first quarter*; so would be invisible in the glare of the sun. Let us now assume about the middle of the great night. The moon would rise in the first quarter, and as she slowly climbed up her face would come nearer to being full till in a little less than seven and a half days she would stand up full at her culmination of  $23\frac{1}{2}$  degrees above the horizon. She would sink at the same rate, gradually coming to the third quarter as she set. To use popular language, the moon would rise half face bright—creep up to full face—and then sink to half face again as she set, remaining up steadily for nearly fifteen days. During the time she was visible she would sweep the heavens—compared with the sun, not once in 24 hours—but once in 24 hours and 50 minutes. This is caused by her monthly motion, which is *against* her apparent motion in the sky. We thus see that the moon rises and sets each lunar month, just as the sun rises and sets each equinoctial year. City people do not notice this very often; but the old farmer needs the moon and puts it in round numbers, "the moon rises three-quarters of an hour later every night." All this is the average an observer would see, but by using instruments, he would find many variations in the moon's motions.

Let us suppose that the moon has set, thus leaving us in the black polar night till the next moon about a fortnight hence. What motions would you look for in the stars? None whatever; the whole celestial dome would appear to stand still day after day. Stars near the horizon would stay there and those overhead would show no motion. But if you went into the observatory and turned a telescope on any star, you would find it moving horizontally. Stars at the horizon would move the fastest, and as you pointed your telescope higher and higher they would move slower and slower till you reached the "pole star," which, as noticed above, would move in a little circle of less than  $2\frac{1}{2}$  degrees, the center being the "polar point," "dead plumb" under which stands our observatory. This slowness and fastness of the various stars is caused by the fact that they all make a horizontal circle in a "sidereal day" of approximately 23 hours 56 minutes. If you wish more information about this "sidereal day"—the 24-hour sun day, and the moon day of 24 hours and 50 minutes—you must go to your cyclopedia, or still better call at the Naval Observatory in Washington, D. C., as space cannot be taken here.

## An Opinion of the Scientific American Supplement.

In The Publisher and Retailer for September, 1909, appears a communication which displays not a little knowledge of the SCIENTIFIC AMERICAN SUPPLEMENT, not only from an editorial standpoint, but from the publisher's standpoint. The writer states:

"A remarkable periodical is the SCIENTIFIC AMERICAN SUPPLEMENT, a sterling weekly established in 1876. The original idea was that it should run out that year and concern itself with the Centennial Exposition, which made Philadelphia famous. But the SUPPLEMENT found itself firmly anchored at the time the owners had planned to kill it, and it has been continued weekly ever since. The remarkable things about it are several—perhaps the most so is that it prints no advertisements, though it is a meaty sixteen-pager of the size of Collier's. For revenue its publishers look only to the circulation end of the game. It is, so far as your uncle knows, the only *bona fide* advertisementless periodical in existence. A file of the SUPPLEMENT is, in a scientific way, the greatest of encyclopedias, nothing finding place in its pages unless of practically permanent interest and value. Even more remarkable, probably, is the fact that all numbers of the SCIENTIFIC AMERICAN SUPPLEMENT are kept constantly in print—ten cents will purchase a copy ten, twenty, or thirty or more years old, as readily as a current issue. The sale of back numbers warrants the publishers in keeping in print the seventeen hundred issued since January, 1876. To make sale for the back numbers, a catalogue is issued from time to time, and in this is revealed the contents of all the issues which have gone before. Remarkablest, perhaps, is the fact that while the SCIENTIFIC AMERICAN is on sale to the trade, and for which there is no back-number sale, the SUPPLEMENT is not, whereas one would think it is the one which should be made returnable, as returned copies would not be dead stock, as must be the case with the other publication."

The Publisher and Retailer circulates largely among newsstand dealers, and the SUPPLEMENT is not designed primarily for newsstand circulation. Hence this opinion of its virtues, addressed to a class of dealers who are not likely to be interested in its editorial merits, is all the more acceptable.

From a report of comparative tests made by an American trunk line on the new ferro-titanium steel rails and those of the Bessemer type it is noted that the wear on the former showed 1.45 pounds per yard, as against 4.18 pounds per yard on the latter, which is nearly 300 per cent in favor of the new alloy steel.

PLAYING A 'CELLO BY COMPRESSED AIR.  
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

At a recent concert in London one of the programme features was a violoncello solo, rendered in conjunction with the "auxetophone," the invention of the Hon. C. A. Parsons of turbine fame. Through the courtesy of the inventor we are enabled to describe and illustrate this novel attachment to musical instruments, whereby the tone of the latter, to which it is attached, is appreciably increased by means of a current of compressed air.

The auxetophone may be best described as a comb or multiple-reed valve of aluminium, which comb is hinged in such a manner that each tooth of the comb can vibrate at a variable distance from a corresponding slot in a little box to which compressed air is supplied at about five pounds pressure. The farther away the teeth are from the slots, the greater is the flow of air, and vice versa. The flow of air is controlled by a valve, and when caused to vibrate, the air transmits corresponding sound waves into the trumpet.

When the auxetophone is applied to the 'cello or any other stringed instrument, the valve is connected by a rod of aluminium with the bridge of the instrument. Thus the valve is caused to vibrate in accord with the characteristic tone of the instrument. The sound issuing from the trumpet, though in many respects identical with that of the instrument itself, is at the same time richer in character and greater in volume.

In the accompanying illustrations the disposition and details of the apparatus are clearly shown. A special bar is carried across the sounding box of the instrument to support the multiple-reed valve and its box. The current of compressed air enters the box at its lower end. The aluminium connecting rod between the valve and the bridge of the instrument is clearly shown.

The air is compressed in a small portable cylinder. The current first passes through a pressure gage at the player's foot, the dial of which can be instantly and easily read and followed. From the pressure gage it passes to a small air filter, which removes all suspended impurities. Then it passes to the lower end of the valve box mounted on the instrument. Between the pressure gage and the filter is a small pedal, by means of which the player can modulate the flow of the compressed air by means of his foot.

The horn is mounted on a stand beside the instrument, and a flexible pipe coupling connects the valve box of the instrument with the horn. The valve mechanism support is so made that it can be attached to or detached from the instrument in a few moments.

At the concert previously mentioned, the possibilities of the invention were very strikingly evidenced. The tone of the instrument was appreciably fuller, richer, and stronger when the auxetophone was attached, the harmonics were clearer, and the high-pitched notes were more clearly defined than is possible without the attachment. In the fortissimo passages the tones had a solid, well-rounded ring of great volume, while in pianissimo the expression of the artist was well produced with a softness accompanied by distinct clearness of the tones.

Timber is scarce at Tucson, Ariz., and fence posts are expensive. Recently, states the Industrial World, the manager of the Tucson Rapid Transit Company found it necessary to string some wire fencing, and in lieu of fence posts he cut up a lot of old boiler tubes into suitable lengths and made holes in them to attach the wire fencing. He made some convenient gates by sliding 4-inch tubes inside of 4½-inch tubes, the collapsible tubes serving the purpose of cross bars. Recently, in sinking a well for power-station circulating water, he utilized the shells of two water-tube boilers, sinking them one above the other to a depth of 36 feet.

## The Budde Hydrogen Peroxide Process for Sterilizing Milk.

The problems confronting a public pure milk supply are only too well known. The greatest difficulties arise from the fact that trade milk is drawn from so many quarters and such a varied assortment of sources, and then promiscuously mixed, that even if the supply from one set of cows should be pure, it is immediately contaminated by its admixture with the product from other doubtful cattle. Sterile milk in the generally accepted sense of the word is practically impossible to obtain. Numerous methods have been evolved for treating milk so as to render it perfectly innocuous. Scalding or boiling are the most commonly favored means for destroying germs, but heat destroys the character of the article, and in artificially-fed children it is invariably productive of rickets and other serious infantile maladies. In pasteurizing milk no two dairymen adopt the same degree of temperature.

Within recent years the tendency has been toward the use of a powerful antiseptic, such as hydrogen peroxide. Although highly successful in its results, the

having only one outlet, the cream not being separated from the milk. This operation not only removes all particles of dirt suspended in the milk more effectively than ordinary filtering, but also serves to arrest any bacteria that may be adhering to the foreign articles and to the minute motes of the tissues of the cow which are always present in milk. It may be mentioned in passing that such cleaning the inventor maintains to be necessary in any milk treatment, since experiments have proved that the bacilli adhering to these different particles are the most resistant. Striking illustration of the extent to which dirt is present in milk is afforded by the amount of residue that is found in the bowl of the centrifugal cleaner after the raw milk has passed through.

From the cleanser the milk passes into a water-jacketed glazed earthenware vat, in which it receives the predetermined quantity of hydrogen peroxide ( $H_2O_2$ ). The temperature of the water jacket can be raised to the requisite degree and maintained thereat merely by the admission of steam. The vat is fitted with a mechanical stirrer, which is actuated from time

to time to create and maintain a homogeneous mixture. The peroxide is perfectly harmless when taken in small quantities. The amount used by Dr. Budde is very minute. The chemical is added to the fluid when heated to the temperature of 122 deg. F.

The effect produced upon the milk by the hydrogen peroxide is that the enzyme catalase, first isolated by Loewe at Washington in 1901, attacks the hydrogen peroxide, and immediately decomposes it into water and oxygen. The result is that the one volume of oxygen thus released—hydrogen peroxide consists of two equal parts of hydrogen and oxygen—immediately seizes upon another atom of oxygen. Consequently, for a very short moment the oxygen is in the form of unic atoms, and exercises a far greater inclination than ordinary oxygen to combine with the oxidizable substances present, which fact explains the well-known powerful oxidizing qualities of the hydrogen peroxide. It is imperative that the  $H_2O_2$  be chemically pure.

The product has been subjected to prolonged searching tests by eminent Swedish, Danish, Austrian, and German scientists and bacteriologists, who have pronounced an eminently favorable verdict thereon. Possibly the most striking of these investigations were those carried out by Dr. Th. Begtrup Hansen at the Silkeborg Tuberculosis Sanatorium in Denmark in comparison with raw and pasteurized milk. The results of these observations were completely satisfactory. It was found that the patients partook of the buddeized milk readily and found it agreed well with them; it was well absorbed and possessed good nutritive value; and in certain cases of gastric and intestinal disease agreed better with the patients than

pasteurized milk, while no ill effects arose from the method of sterilization. Its greatest advantage, however, was its sterility, while the fact that it insured the destruction of tubercle bacilli in mixed milk from several cows, such as ordinarily exists in trade milk, i. e., that generally provided for the public, was especially commented upon.

The wireless telegraph stations along the British coast established by the Marconi Company and the Lloyds have been taken over by the British Post Office, and hereafter will be operated by the government. The long-distance stations, however, at Poldhu, Cornwall, and Clifton are not included in the transaction and still belong to the Marconi Company. This act of the British government will no doubt mark an important step in the commercial use of wireless telegraphy, because the Marconi Company has heretofore refused to communicate with vessels not equipped with the Marconi system of wireless telegraphy. The British government will of course make no such distinction.



Fig. 1.—'Cello with the auxetophone attached which delivers the sound waves to the trumpet. On the floor is a pedal for modulating the air pressure, a pressure gage, and air filter.



Fig. 2.—View of the instrument, showing mounting of the valve mechanism and aluminium connection between the bridge of the instrument and the valve.

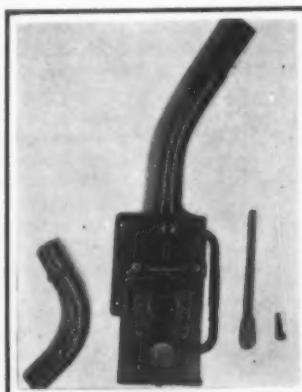


Fig. 3.—View of the instrument looking on the delivery side of valve.

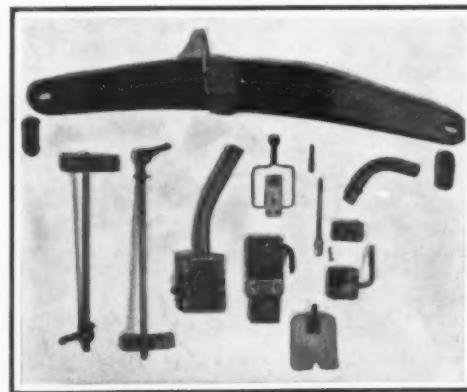


Fig. 4.—The several component parts of the auxetophone.

## PLAYING A 'CELLO BY COMPRESSED AIR.

use of antiseptics requires care, since otherwise the requisite effect is not achieved or the taste of the milk is quite changed. A Danish chemical engineer, C. Budde, D.Sc., of Copenhagen, has for some time been prosecuting his investigation along these lines, and after prolonged experiment has succeeded in evolving a process which has received the indorsement of such eminent bacteriologists as Prof. Von Behring, Dr. Riedel, Prof. Tanner Hewlett, and other well-known luminaries at the leading institutions of Europe. So effective is it in its application, that buddeized milk, as it is generically termed, is becoming extensively consumed not only in Denmark, but other European countries and Great Britain.

Although it appears somewhat elaborate in comparison with the popular dairy methods, the process is so inexpensive as to enable the purified milk to be sold at the customary price. The milk upon collection from the various farms is brought to a central depot, where it is raised to a temperature of 122 deg. In this heated condition it passes through a centrifugal cleaning machine similar in design to a separator, but

## MOVING A MOUNTAIN IN UTAH.

One is accustomed to think of mining operations as being conducted deep in the bowels of the earth, and of miners working in cramped positions and an unwholesome atmosphere of powder-smoke and grime. In Utah, however, mining operations are conducted for the recovery of metal on a truly enormous scale, out in God's good air and sunlight, in the course of which a mountain is being leveled instead of caverns being hollowed out within the earth's crust.

years later the Utah Consolidated Copper Company, with that mine as its principal asset, made a profit of \$2,750,000 in a year, and is still making an increasing output.

Copper is the determining factor that has made all the difference.

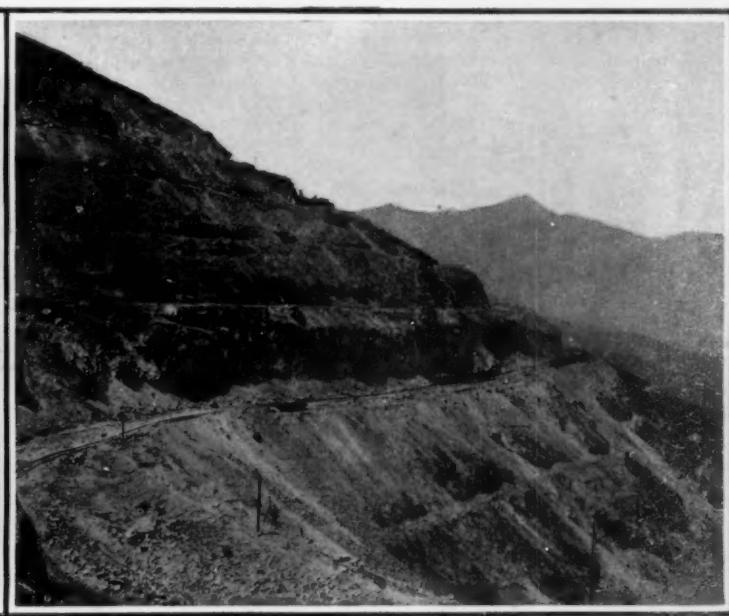
In 1896 Mr. Newhouse secured sufficient capital to erect a cyanide plant, and the mine was a fairly profitable gold producer for a time, but profits dwindled and ceased, surplus capital evaporated, and total failure

that mine, now known as the Utah Consolidated Copper Company. Prospecting on these revealed an enormous lenticular deposit of copper sulphide, formed by replacement in limestone, and even this was not the limit, later investigation showing hundreds of acres of old igneous intrusive monzonite to have been impregnated with copper solutions, possibly by the same later eruptive action as caused the replacements.

This forms the property of the present Boston Consolidated Copper Company, and the mountain now be-



Aerial cable tramway sending down to the railway ores from the Utah Apex mine.



One of the "benches" above the tramway shown in frontispiece of this issue.

Nor are the unusual, even sensational, methods of mining adopted the only interesting features in the history of the Boston Consolidated and adjacent mines at Bingham Cañon, Utah. In all the history of mining, always fascinating by reason of its surprises, there is no story more romantic than that of the transformation of the Highland Boy, on the verge of failure as a gold mine, into one of the largest copper producers of the world.

The iron gossan outcrop in Bingham Cañon had long been a local landmark, and was known to contain gold to the value of \$4 to \$8 a ton, but in a very refractory state; in 1895 the Highland Boy mine, upon which considerable development work had been done, was offered for sale as a gold mine for \$300,000, and refused after examination by a Montana syndicate. Ten

seemed imminent, when, toward the end of 1897, rock that was going over the dump as waste was found to contain 8 per cent of copper. The lowest development adit had penetrated a large body of iron pyrites containing enough chalcopyrite to bring it up to the above value.

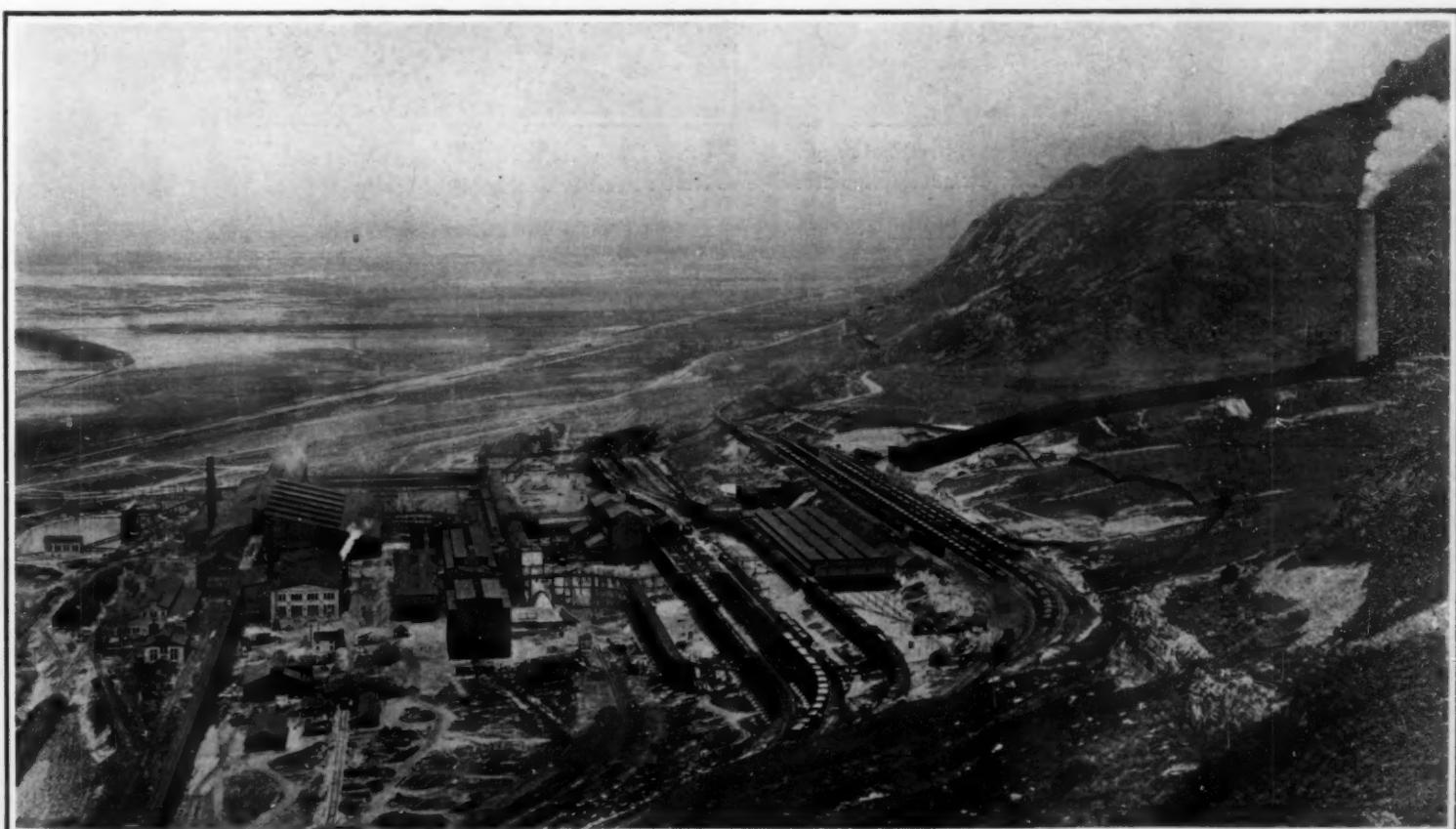
Prospecting in the same neighborhood by Col. E. A. Wall's associates disclosed a great laccolite of monzonite porphyry, half a mile long and extending well up the mountain ridges, containing—if everything assaying over 1.5 per cent copper is considered an ore—over two hundred and fifty million tons.

The overlay of the Highland Boy sulphide deposit was also found to be largely impregnated with copper, and this led Mr. Newhouse to acquire large holdings adjoining, but not included in the combination owning

ing moved, as shown in our front-page illustration.

Operations were commenced upon the underground sulphides assaying as much as 8 per cent of copper, but it was at first a question whether the higher impregnations could be mined at a profit. Ore carrying as little as 1 per cent had been profitably mined at the Atlantic in Michigan, but that was native copper, whereas the Bingham deposit was all sulphide. On account of the latter being so readily accessible, however, practically no shaft sinking or pumping being required, it was very cheaply mined, and, with the present stripping methods breaking enormous quantities of rock at very low cost, a handsome profit over mill and smelter costs is shown.

The solid sulphide ore mined below still pays for the operations on the mountain top, ore being stoped



A great smelter at Garfield, Utah, built especially to treat the ores excavated at Bingham Cañon.

MOVING A MOUNTAIN IN UTAH.

from three underground levels in a deposit at some places 100 feet wide. The ore is discharged from the upper to the lower levels by chutes, and from the lowest directly into cars of the "high line" of the Rio Grande Western, which convey 750 tons daily from the Boston Consolidated to the smelter of the American Smelting and Refining Company at Garfield.

The stripping operations at the top of the mountain began with the removal of waste rock overlying the enriched monzonite, the ground having been leached of its values to a depth varying from 30 to 60 feet. This waste is carried round the mountain and dumped on the far side, where the ore body lies lower and could not be eventually mined by removal of the overlay. Now, however, sufficiently rich ore to be sent to the mill is being stripped in the same way, and sent down by the tramway shown in our illustration, the whole of the rock exposed by each blast being carefully sampled and assayed and sorted accordingly.

For the stripping operations five steam shovels were first sent up the mountain by a specially-built railroad with numerous switchbacks.

The hilltop is laid out in four benches from 40 to 120 feet high, the highest bench being kept farthest back, so that rock blasted there does not fall upon and impede the tracks upon the bench below. Well-drilling machines are used to drill 5-inch holes 30 feet apart in a line as far back from the face of each bench as the explosive will break. When the holes reach the level of the bench below, they are pumped out and "sprung" with 25 sticks of 40 per cent dynamite, again with 50 sticks, and sometimes again with 75 or more. This makes a chamber at the bottom of the hole large enough for the breaking charge, which is from 20 to 60 boxes of powder per hole. A row of holes is fired simultaneously by electricity, and the whole face of the bench is moved and shattered so that it can be handled by the steam shovels. On the average 2.8 tons of rock is broken per pound of explosive used, and 0.68 ton per foot of hole drilled. Masses too large to be handled by the shovels are drilled with percussion or air-hammer drills and split up.

Each of the shovels is of 30-ton capacity, with a 5-ton dipper. Two trains of wooden dump cars attend each shovel, and the latter fill the 4-ton cars at the rate of about one a minute. Four shovels, each working two shifts of ten hours, have handled 14,000 tons in a day, making 175 tons per hour each. The cost of excavation has been as low as 12 cents per ton of ore delivered in the cars, including explosives, labor, and shoveling.

The ore selected to go down to the mill is dumped by the cars in a 400-ton receiving bin at the top of the incline shown in our illustration, which feeds it into the 12-ton skips of a balanced gravity tramway. The latter has two pairs of tracks 2,100 feet long descending the hillside at a gradient varying from 23 deg. to 27 deg. The skips discharge about 150 tons per hour into the steel-tank receiving bin at the foot of the tramway, having a capacity of 3,000 tons, which discharge directly into the railroad cars of the high line.

The smelter at Garfield shown in our illustration was built especially for treatment of the ores of the Boston Consolidated Utah Copper Company, and other mines of the neighborhood after contracts had been made with them providing for a certain constant supply.

On account of the mountainous and irregular nature of the ground aerial cable tramways are found to be the cheapest means of transporting the ore in some cases, that of the Utah Apex mine being shown in one of our illustrations. In these buckets suspended from rollers travel upon a fixed cable supported on towers, the buckets being clamped to an endless travelling cable passing round drums at the head and foot of the line, the weight of the loaded buckets descending carrying up the empties on the other side.

From present indications only the price of copper can limit the alteration of the horizon in Bingham Canyon, the time being measurably distant when the gulches will be filled up with waste rock and the mountain top reduced to about their level.

#### A NEW AUTOMATIC ELECTRIC SIGNALING SYSTEM FOR RAILROADS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An important development in automatic signaling for railroads has recently been introduced in Great Britain by the Great Western Railroad, the foremost trunk line in the country. Despite the elaborate nature of the block system, and the strict rules laid down in connection with its working, several accidents have recently occurred in the country owing to the ordinary semaphore signals, especially those at the distant point, being inadvertently overrun by the engineer, more particularly in the case of express trains, the mishap being due to the signals being obscured by fog, snow, or rain. Notwithstanding the excellence of the block working, this dependence upon the human element has proved its weakest link. The Board of Trade department of the government, which is responsible for insuring the safe operation of railroads, has long advocated the adoption of an automatic signaling system whereby the engineer is given on his engine not only a visual but also an audible indication of the condition of the section upon which he is entering at any time, since it is realized that the momentary occupation of the engineer's attention to any other detail on the locomotive at the instant of passing a signal might easily jeopardize the safety of his train.

The Board of Trade officials have subjected the latest idea, which has been adopted by the Great Western Railroad, to the most severe and exacting tests; and

circuits a danger signal is conveyed to the engineer whether the road is clear or otherwise, so that his attention is drawn to the fact instantly. Also, should the insulation of the ground apparatus be broken by the presence of grease, dirt, snow, water, etc., so that the electric circuits cannot be connected, the danger signal is instantly sounded. In addition to the siren and electric bell placed in the locomotive cab, there is an indicator extending corresponding visual signals, the danger signal being represented by the word "danger" printed on a red ground appearing in the glazed aperture of the indicator, while "line clear" is represented by a clear white space. It will be realized therefore that much of the value of the system lies in the fact that the danger signal is operated whenever any untoward circumstance exists, such as apparatus breakdown, disturbed insulation, etc., whether the line be clear or *vice versa*.

Immediately beneath the cab of the locomotive is placed the shoe (in the accompanying photograph the tender of the locomotive has been removed to show its position), which comes in contact with the fixed ramp, during the passage over which it is lifted. The normal position of this shoe is  $2\frac{1}{2}$  inches above rail level, but when passing over the ramp, owing to the latter projecting some distance above rail-level, it is raised about  $1\frac{1}{2}$  inches. This contact shoe is of stout construction and is capable of adaptation to any type of engine. The contact face is 7 inches wide and it is case-hardened. There is a strong spiral spring provided which insures the shoe returning to its normal position directly it leaves the ramp. This shoe is insulated from the mass of the engine, and the caution signal is operated by the disruption of a local electric circuit on the locomotive. In its normal position the shoe serves to complete this electrical circuit; but directly it is raised, as when passing over the ramp, and even if only raised  $\frac{1}{2}$  inch, the circuit is broken. The result of this circuit interruption is that a steam whistle is brought into action which has previously been held closed by the circuit.

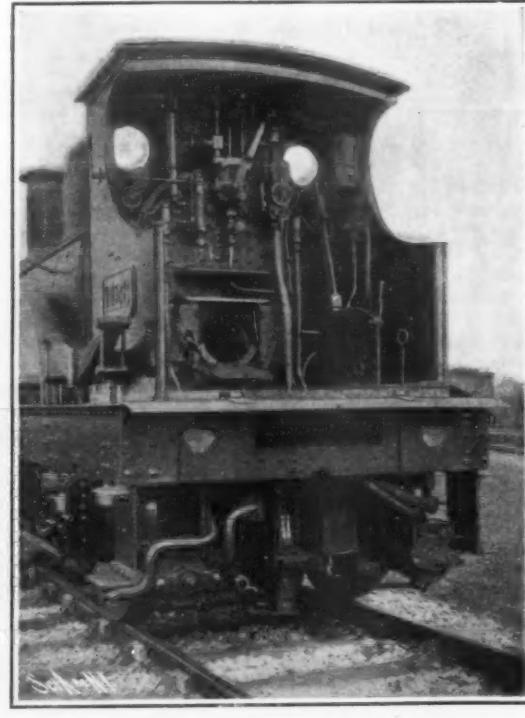
In connection with the whistle and bell signals, an indicator board is attached at the side of the cab. There is a large slot before which appears the notification "Danger" upon a red ground, when the signal is against the engineer, giving way to a blank white space when the line is clear, these two notifications coinciding with the whistle and bell signals.

although it is valuable as an auxiliary to the ordinary semaphore, it can be safely operated without the latter, and as a result of their investigations have conceded to this railroad permission to remove their semaphores and operate a section of their track solely upon this new system, which concession is the first that has ever been granted to any English railroad and consequently marks an important era in the safer working of railroads.

The system adopted is entirely electric, there being no mechanical parts, such as triggers, to come into contact, so that no concussions can result which might imperil the durability of the invention. Upon the locomotive is carried a downward projecting shoe, similar in design to that utilized upon street railroad cars to collect the current from the feed rail, and this shoe comes into contact with a long section of ramp laid between the tracks, thereby establishing electrical communication, and notifying the engineer in the cab both visibly and audibly whether the section of road he is entering is blocked or clear. These audible signals comprise a steam whistle or siren, which is sounded to notify that the signal is at "danger," while "line clear" is signified by means of an electric bell. Either of these signals, when once set in action, continues to sound until it is stopped by the engineer, so that the latter must inevitably realize the condition of the track by stopping the whistle or bell, thereby accepting the warning extended to him. Both signals are given by the operator in the signal cabin to the engineer without the movement of any apparatus on the track, this latter constituting a fixed ramp. Moreover, should there be any breakdown in the electric



Section of track provided with central ramp.



Rear view of locomotive, showing contact shoe.

#### A NEW AUTOMATIC ELECTRIC SIGNALING SYSTEM FOR RAILROADS.

The cause of the disappearance of rust from iron bars, etc., used in the erection of reinforced concrete structures, has been traced by Rohland, in *Stahl und Eisen*, to the presence of acid carbonates and sulphates in the cement, these salts dissolving the iron oxide and leaving the metal bright. The cement in setting absorbs carbonic acid from the air, thus forming the necessary acid carbonates; and experience has shown that the de-rusting process is effected while the concrete is setting and commencing to harden. This discovery affords an additional guarantee for the safety of reinforced concrete structures, inasmuch as the metal is protected from rusting by the alkaline reaction of the cement during the mixing process, and any rust on the bars is removed by the action of the acid carbonates at an early stage in the erection of the structures.

## THE VESSEL THAT ACCOMPLISHED THE NORTHWEST PASSAGE.

BY J. WAYNE BALTIMORE.

The Norwegian seventy-five-foot sloop "Gjöa," which is famous the world over for having been the first and only craft to have threaded its way through the Arctic Ocean from the north Atlantic to the Behring Sea, is now the property of the city of San Francisco. Capt. Roald Amundsen, the noted Arctic navigator, sailed from Christiania, Norway, with a crew of seven in the year 1903, and after nearly three years he succeeded in reaching Nome City by way of the Northwest Passage. From there he sailed his little vessel out into the Pacific, and thence down the coast to San Francisco harbor. Later he returned to Norway, leaving the "Gjöa" at the Mare Island navy yard. The little craft was turned over to the Norwegian consul at San Francisco by his government, with instructions to make whatever disposition of this historic vessel he deemed best. The consul finally concluded to present the "Gjöa" to the city of San Francisco in behalf of the Norwegian government, to be preserved as a relic and souvenir of the feat of Capt. Amundsen in making a voyage through the Northwest Passage.

The city authorities gladly accepted the gift of the famous old craft, and decided to place the vessel in a conspicuous position at the extreme western confines of the Golden Gate Park, just bordering on the ocean beach.

The "Gjöa" was fitted into a cradle of wood, and loose dry sand filled in all around up to the water-line. The work of hauling the old sloop out of the sea up the beach for a height of more than 40 feet and several hundred feet across the big boulevard to the point where it is mounted in permanent position proved a very heavy and difficult task of engineering. Several days were required to accomplish this work.

The total weight of the empty hull of the "Gjöa" is estimated at 300 tons. The total length over all is 75 feet; length of waterline, 65 feet; beam, 16 feet; depth of hold, 16½ feet.

The "Gjöa" was not primarily intended for Arctic navigation. When purchased by Capt. Amundsen, the vessel was reinforced with stout wooden and iron beams and sheathed with an outer layer of 2-inch planking and fitted with a petroleum engine of 39 horse-power and a two-bladed propeller. However, sails were depended upon as main motive power.

## A TAME NAUTILUS.

BY CHARLES F. HOLDER.

The accompanying photographs show a paper nautilus which was so tame that I could handle it with impunity. The animal was brought to me without a shell, and I provided it with one.

The beautiful animal seized upon it with all the eagerness of a homeless hermit crab, occupying it at once. When alarmed it would crouch low, its entire body and tentacles drawn into the shell; nothing but the green eye to be seen peering over the edge. Then, when satisfied that all was well, it would gradually come out, changing tint and shade of blue all the time, presenting a most interesting spectacle. Now the two large shell-forming arms would creep out and slowly envelop the shell, until it was entirely covered by the speckled blue mass. The animal would do this even when I held the shell. The animal did not display any fear, and would throw its tentacles about my fingers, and even

leave the shell and permit me to handle it. This is well shown in the illustration, where the animal is leaving the shell which I am holding. Its big blazing silver shell-making tentacles are being thrown over my hand, while the other arms are toying with the weed at the bottom.

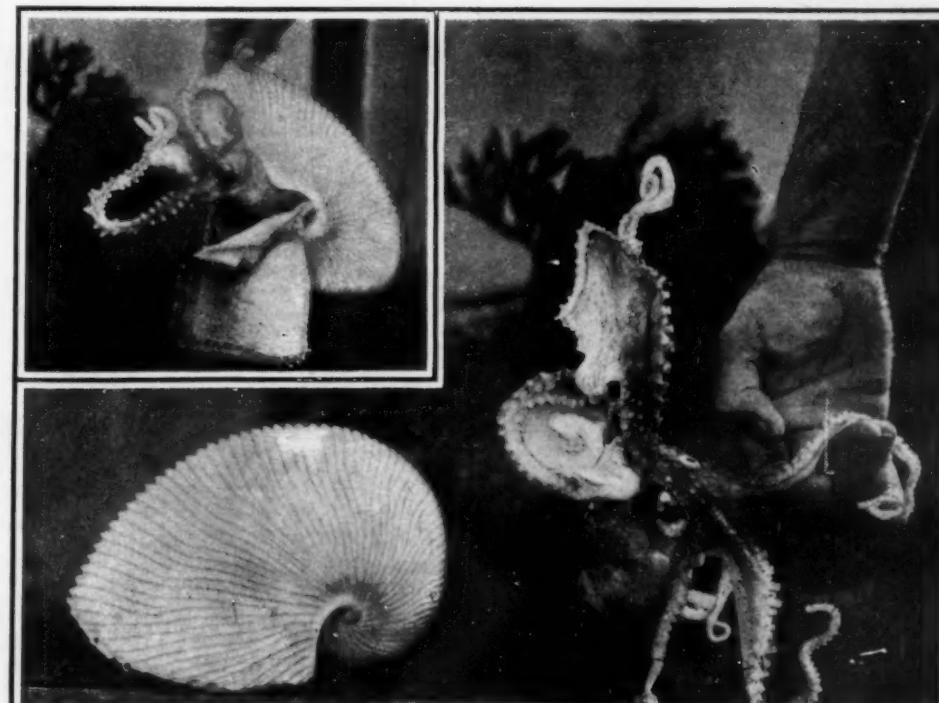
The dark spot in the center is the mouth, or the black mandibles surrounded by a white circle of muscle. In another view the animal is seen entirely out of the shell; its mouth near my thumb, one long tentacle thrown across my fingers, while the big



THE "GJÖA" BEACHED AND ABOUT TO BEGIN ITS "INLAND VOYAGE" TO GOLDEN GATE PARK.

spreading tentacles of silver and blue are being waved aloft like brilliant Venetian banners. The eye is shown as a pure white spot, just below the mouth and near the large gill openings. Below this hangs the bag-like body. When I withdrew my hand the nautilus fastened itself to the glass sides of the tank and hung, a glistening mass of color, scintillating in the light. Not one person out of a thousand could even guess what it was. Even teachers of zoology, when the shell was taken away, failed to recognize it, and there was some reason, as this was the first opportunity they had had to see the animal really alive. By placing a cloth over the tank, and raising and lowering it, the nautilus could be made to change its color.

If the broad tentacle is examined it will be seen to



SCENES IN THE LIFE OF A TAME PAPER NAUTILUS.

have radiations which correspond to those of the shell itself. It also bears numbers of glands, and clings tenaciously to any object it may touch. These tentacles are the shell makers, and part of the work in shell making was observed in a specimen that had no shell. Resting on the bottom, it held its two shell-secreting arms above, side by side; in point of fact, they were joined at the base. Then from the glands oozed the shell-making secretion and it soon appeared

as a gelatinous cast of each tentacle, the exact size of the shell the animal had been inhabiting.

The radiation on the face of the tentacles made the radiations on the shell, and one could imagine that gelatin had been pressed into the molds and allowed to harden; and this is practically what is done. The two molds (tentacles) are held up close together; the left one forms the left side, the right one forms the right side. Then by manipulation they are joined together. Indeed, the two tentacles have been joined all the time, and so form a mold in which the beautiful shell or egg capsule is made. I watched this radiant creature all day and late into the night, and the following morning part of the new shell was found, a delicate, tenuous mass, that would gradually harden. Hence I believe that a new and large shell can be produced in a few hours, and nearly a whole one was made by this animal in the Avalon zoological station between 1 o'clock in the morning and 9.

It is given in all the textbooks, I believe, that the male of the argonaut is a minute animal hardly an inch long. This cannot be so in all species. I have a male which has a radiant spread of eight or nine inches, and is as large as the female. The female lives in the shell and deposits her eggs here—yellow masses which hang in the shell. I saw her leave

the shell and wander about at will, darting into 't when alarmed, and having practically all the habits of an octopus. The male of this species is large, and might readily be taken for an octopus, having its habits. The beautiful animal appears at the Southern California channel islands, especially Santa Catalina, in February and August, from ten to twenty shells being found every year. Doubtless hundreds come ashore, but are deserted and broken.

The argonauta that I have kept in confinement, three in number, were extremely interesting. They would eat fish from my hands readily, and displayed little or none of the timidity of the octopus. When alarmed they would dash away, filling the water with ink and propelling themselves by the siphon, out of which they

sent water with such force that when held above it, the stream would go five or six feet through the air. I noticed that the octopus tried to use this as a defense, as when I moved my hand near its egg cluster it would direct the siphon at me, and shoot a stream with such force that it was easy to see that small enemies, at least, would be blown away.

The Grand Trunk Pacific Railway (Canada) has commenced a novel undertaking whereby a record of the growth of the West so far as the railway is a factor in its growth will be kept. The official photographers of the company have begun to work on the plan of the company, and towns along the line will be photographed, each photograph being duplicated yearly, so that a continuous record may be obtained and kept of each individual town from the time it sprang up throughout the period of its growth. The record

kept is expected to be of invaluable importance in years to come.

In British Columbia platinum is found in many of the alluvial gold workings, where it can be saved as a by-product. The saving of it in a small way is, however, attended with so much trouble that it has been practically neglected and no appreciable production made recently.

RECENTLY PATENTED INVENTIONS,  
Pertaining to Apparel.

**BURIAL-ROBE.**—C. I. OWEN, New York, N. Y. The aim of this invention is to provide a construction which will enable collars of different styles to be used with the same grave clothes, and which will also enable the collar to be readily attached or detached to and from the clothes and around the neck of the body.

## Electrical Devices.

**ARMATURE.**—J. P. NICKONOW, Evansville, Ind. The invention relates to armatures of a type suitable for dynamos and motors, the particular purpose being to render the armature strong and durable, and especially braced against the influence of centrifugal force. It relates to means for improving the circulation of air adjacent to the armature, in order to prevent overheating of the windings thereof.

**ELECTRIC THERMOSTAT.**—J. R. CARPENTER, Hancock, Mich. The invention pertains to electric thermostats, the more particular purpose being to provide a construction in which the action is alternative; that is to say, either an increase or a decrease in the temperature beyond a predetermined limit will cause an alarm to be actuated.

## Of Interest to Farmers.

**HAY-RETAINING DEVICE FOR HAY-STACKERS.**—J. O. MCCREARY, Fort Morgan, Colo. In a well-known apparatus a series of parallel teeth are pivoted to a head forming part of the stacker frame which rests on the ground. Hay is carried up to the stacker and deposited by a sweep rake. The teeth of the stacking apparatus are provided with pivoted fingers for retaining the hay deposited thereon, said devices being adapted to release the hay when the teeth are raised for throwing the hay backward. The invention is an improvement in construction and attachment of the hay-retaining fingers.

**SEED-DRILL.**—G. W. NATION, Alliance, Neb. In operation the framework being drawn through the field, the disks which are provided with radial sickle-shaped blades stir up the soil, and prepare it for being furrowed by furrow openers of the drilling attachment. The rotation of the dropping wheels permits the grain to move in predetermined and regular quantities through shoes into the furrow, and the shoes may be adjusted to any position by a handle.

**CORN-HANGER.**—E. F. SWANSON, Galena, Ill. The invention is an improvement in corn hangers for hanging ears of corn for use as seed corn or otherwise. Brackets are arranged in pairs and consist of two wires loosely wound at their middle portions side by side around the round part, or bearings, usually two full turns, with their free ends bent upward to receive the ears, and when in use the brackets are turned on the round portions to space apart the adjacent arms. It is suspended by a hook.

## Of General Interest.

**TRESTLE.**—R. J. KOCH, New York, N. Y. The improvement is in trestles of a folding or knock-down type for general use where such an elevated support is required, and has in view a trestle preferably in the main constructed of sheet metal, providing a relatively strong structure which, when disassembled, may be packed within a space approximately not larger than the trestle beam.

**SHIPPING-CASE.**—C. C. NOTCHKISS, Great Bend, Kan. The invention is adapted to various kinds of shipping case devices, and relates primarily to the corner connections between the several walls of the case, the same being so constructed as to permit of the rapid and convenient assembling and disconnection of such parts, and producing, when erected, a case capable of withstanding rough usage.

**SEPTIC TANK.**—A. W. HUCHMAN, Staunton, Ill. The tank is for use in sewage disposal, in which the sewage is partly purified by means of fermentation or putrefaction, in which the passage of sewage therethrough can be readily controlled, which permits it to escape in case the outlets are clogged so that the material backs up within the tank, and which is provided with manholes, and manhole covers so that the tank can be tightly closed, while access can be easily had thereto.

**HATCH.**—A. N. MCGRAY, Boston, Mass. This hatch cover can be securely battened down upon the hatchway to prevent water from entering the hatch if the vessel is laboring in a seaway so that waves break upon deck, or to prevent the escape of liquid from within the vessel where a hold section has become filled by bulk, or is served as container for liquid in bulk, or is filled with liquid for ballast or stability purposes, which can be easily manipulated and in which "dead" space under the deck is reduced to a minimum.

**GAGE FOR DEEP-SEA SOUNDINGS.**—J. MEL and T. JONES, JR., Galveston, Texas. One purpose of the invention is to provide a liquid gage or recorder for deep sea soundings, so constructed that it will contain no moving parts, and so that its action is both positive and direct, and so that the instrument can be used an indefinite number of times without any delay.

**BOTTLE-WRAPPER.**—E. C. RINNER, Coshocton, Ohio. The invention pertains particularly to that type of wrapper which is formed

of corrugated cardboard or pasteboard. The improved construction tends to distribute the pressure when a number of articles covered by the wrappers are packed in a shipping case.

**CEMETERY STRUCTURE.**—G. C. SIMPSON, West Newton, Mass. The invention refers to reinforced concrete and provides improvements in cemetery structures, such as mausoleums, memorials, burial vaults and the like, whereby the structure is rendered exceedingly durable and fireproof, can be cheaply erected, and enables the builder to provide any architectural features and an unlimited variety of designs and appearances.

## Hardware.

**CURRYCOMB.**—A. C. DITMAR, Davenport, Wash. This currycomb will be substantially self-cleaning, that is, it is constructed in such a way that when pressure is removed, cleaning devices which are attached to the sides of the teeth will move down toward the points of the teeth in such a way as to clean or wipe them.

**NUT-LOCK.**—W. E. FRAZEE, Perham, Minn. In this invention the object is to provide a device simple and efficient in construction and inexpensive to manufacture, which will effectively lock a nut in place on the shank of a bolt against accidental displacement, and which can be readily loosened by hand.

**TOOL-GRINDING APPARATUS.**—G. W. RIDDELL, Breckenridge, Mo. A leading feature in this invention is the arrangement of the three hollow legs composing the frame in such convergent relation to the shaft of the grinder proper that one serves as a support for the said shaft and another as a guide and protector for a retracting spring connected with the shaft.

**SOLDERING DEVICE.**—F. S. CHAPMAN, Kenton, Ohio. The invention provides improvements in means for use in soldering metallic parts and is especially applicable to those joints used in electrical constructions which require a good metallic contact in order to provide against undue resistance to the electric current in the conductors at their point of union.

**OILSTONE-HOLDER.**—F. J. BADGE, Brooklyn, N. Y., and C. L. CARLE, Salfords, Horley, Surrey, England. In general, this invention consists of a relatively long bar provided with a handle and having a tool seat on one face extending in the direction of its length, preferably V-shaped in cross-section, and a spring to bind on the inner end portion of the tool and force the tool to the seat, adjustable along the length of the member.

**PROCESS FOR THE MANUFACTURE OF A MIXTURE OF GAS AND AIR FOR ILLUMINATING PURPOSES.**—F. W. WOLFF, Berlin, Germany. This process is for use in the production of a gas and air mixture for illuminating purposes, there being a connection with the pipes of a gas work and employing a suction and forcing apparatus which produces and sucks the mixture at low pressure and feeds it at an increased pressure to the consumption place.

## Heating and Lighting.

**GAS-PRESSURE REGULATOR.**—J. G. WILSON, New York, N. Y. This gas pressure regulator is for use in the service pipe between the gas meter and the burners, and is arranged to insure uniform pressure at the burners, to render the regulator exceedingly sensitive, and to prevent the working parts from sticking.

**DRIER.**—J. M. URGELLES, Barncon, Cuba. The drier is intended more especially for coffee and similar materials. It consists of a section oven, each section divided into drying compartments, each compartment having a track therein, a truck movable over the track having containing drums, with the axes extended through a plate which forms the front of the compartment and carries means for driving the drums, steam coils arranged in the compartment under the drums, and means for introducing hot air jets over the drums.

**MANHOLE AND BONNET FOR PIPES AND FURNACE-CASINGS.**—E. PANNENBORG, Syracuse, N. Y. An object of this invention is to so construct the cover or bonnet for closure of an opening formed in a hot air furnace wall or a hot air pipe, that the material removed in the formation of such an opening will be used in the production of a bonnet or cover therefor, and thus economize material.

## Household Utilities.

**STOVE.**—F. MADSEN, Wilbur, Wash. The present invention has for its principal objects the following: first, to increase the available radiating surface in a stove; second, to cause the heated gases to maintain closer and more intimate contact with the metal of the radiating surfaces; third, to regulate the output in heat of the radiator.

**COMBINED NAPKIN RING AND HOLDER.**—W. L. BARNARD, Halstead, Kan. The intention here is to provide a ring and holder simple in construction and inexpensive to manufacture, which can be used to hold a rolled napkin when the latter is not in use, or which can be converted into a holder for securing the napkin in position upon the body of a person during meals.

**STOVE.**—E. C. COLE, Chicago, Ill. The invention comprises a plurality of series of fire

bricks arranged one series above the other, and a series of spaced apart vertical draft columns between the bricks and extending across the joint between the series of bricks, and provided with openings, the columns operating to hold the bricks in place.

**CHAIR.**—I. MARON, New York, N. Y. This chair is capable of being converted for various uses. The invention consists in a device comprising an arm chair having a removable seat that can be so fitted to the arms and back as to cover the intervening space and provide a table bounded by the upper contour of the chair.

## Machines and Mechanical Devices.

**STAVE-CUTTING MACHINE.**—E. C. THORNSCHMIDT, New York, N. Y. The object of this invention is to provide a new and improved stave-cutting machine, arranged to quickly and accurately give the desired shape to the stave, both as to the longitudinal contour of the side edges as well as the bevel thereof and without requiring handling of the material.

**AUTOMATIC LOCK FOR HOISTING APPARATUS.**—R. M. RODGERS, New York, N. Y. The invention appertains to an improved locking device for hoisting appliances, more especially dumbwaiters, in which relation it automatically operates under the tendency of the load to lock the car in any position of its movement immediately after the pull on the hoisting wheel ceases.

**GUIDE ATTACHMENT.**—H. HOLMES, Dufey, Cal. The main purpose here is to so construct the guide that the cable may be readily removed therefrom without disassembling the device; and a further important object is to so connect the body of the device to the stationary support that it may freely rotate in respect thereto but cannot become detached therefrom.

**GOVERNOR.**—G. H. WILSON, Spokane, Wash. The object of the inventor is to provide a new and improved governor, for use in automatically checking the speed of automatic fire escapes and other machinery requiring a steady, uniform motion. When the machine again runs at a normal rate of speed the piston is returned to its normal position by the action of a spring.

**WASHING-MACHINE.**—J. D. WILLIAMS, Clay City, Ky. In this case the purpose is to provide novel details of construction for a washing machine, which embody reciprocating rollers with a corrugated spring-pressed plate in the suds box, and other novel features that co-operate and together afford a simple, very effective and convenient machine.

**LOCK FOR DAVITS.**—W. J. RYAN and L. TANNING, New York, N. Y. The invention refers to davits and associate mechanism for handling small boats on shipboard. The invention comprehends a davit including a staff which may be turned for the purpose of handling a boat, the limits of the turning being adjustable at will.

**DISPENSING-MACHINE.**—P. C. PETERSEN, Perth Amboy, N. J. The invention is an improvement in machines for dispensing cigarettes and matches or similarly-shaped articles and has in view an apparatus to be actuated by a check or coin-controlled mechanism and which will deliver a cigarette and a match at each operation.

**FLYING-MACHINE.**—W. H. MARTIN, Canton, Ohio. Two general principles are comprehended in this invention, one serving to effect an automatic adjustment of an aeroplane to such an angle to the horizontal as to cause it to have a buoyant tendency from the resultant upward pressure against its lower sides. The other serving for the automatic balancing, or self-righting quality of the aeroplane as against tendency to dip sidewise about its axial line of flight.

**ELEVATOR.**—W. T. LONG, Sumner, Wash. In this elevator, Mr. Long provides a carriage, a frame being provided to travel in guides in the carriage, a yoke being disposed in the frame, two clamps being pivoted to the yoke, the clamps being also pivoted to the frame, the means being provided to limit the movement of the yoke and to move the frame relatively to the carriage.

**OIL-FEED FOR DRILLS.**—M. GALLOWICKS, New York, N. Y. The object of this invention is to provide means for feeding oil through the bit of the drill to its cutting point. More specifically the device embodies an oil head which is formed above the drill chuck, and this oil head is provided with means for controlling the flow of oil from the reservoir through the oil duct which is formed longitudinally in the drill.

**PUMP.**—F. FOLEY, Crowley, La. The valve in this case comprises a series of members arranged in superimposed position, adapted to seat, one above the other, effecting closing position, and at the same time being adapted to lift, or be lifted, to opening position. The valve is designed for use upon a pump piston having an opening vertically therethrough.

**FEED MECHANISM FOR TUBE-CUTTERS.**—W. CUSHING, Claysville, Pa. The object of the invention is to provide a feed mechanism for feeding a mandrel used for forcing the cutting wheels of the revolutive cutter outward in a gradual but positive manner, to insure the proper cutting of the cutting wheels without danger of injury to the same.

## Prime Movers and Their Accessories.

**VALVE-GEAR.**—T. O'BRIEN, New York, N. Y. More particularly stated the invention comprises a construction whereby certain movable valves actuated periodically by push rods are readily disconnected from the latter and from their housings, and thus removed from the engine and easily replaced within the engine by reversing the steps necessary to remove it.

## Railways and Their Accessories.

**COMPRESSED-AIR SIGNAL.**—R. ARMSTRONG, Victoria, British Columbia, Canada. Particularly stated the invention comprehends a whistle operated by compressed air from the signal pipe, and valve mechanism controllable by variations in the pressure of air within the signal pipe for controlling automatically the supply of air to the whistle.

**DELIVERY APPARATUS.**—H. B. MURRAY, JR., Portsmouth, Ohio. More particularly the invention relates to apparatus adapted to be used in connection with railroads or the like, for delivering messages and dispatches. It can be used for delivering messages from a car to a point alongside a track or vice versa, and is so constructed that one or more messages can be delivered without the necessity of resetting the apparatus.

**RAILWAY-CUSPIDOR.**—W. HILL, Albany, N. Y. The invention relates to certain improvements in cuspidors especially designed for use in railway cars or other vehicles, and one object is to provide a device which may be readily moved about to bring it to the desired position, and which will automatically drain to the exterior of the car.

**BOX-CAR DOOR.**—W. T. ANFIELD, St. Louis, Mo. The invention is an improvement in the class of doors for box freight-cars, and other inclosures, which are adapted to roll parallel to the side of the car or inclosure, for covering or uncovering the doorway. For convenience in moving the door, it is provided with a handle arranged adjacent and parallel to the curved or contact portion of the door-rail.

## Pertaining to Recreation.

**DEVICE FOR ASSISTING IN THE SHOOTING OF MARBLES.**—H. O. HUGHES, Slatington, Pa. The aim in this case is to provide a cap which is adapted to be disposed on the thumb of the player, the cap having an outwardly disposed stud intermediate of its ends, which is adapted to engage a marble when it is held between the finger of the player and the cap covering the player's thumb.

## Pertaining to Vehicles.

**Brake for Vehicles.**—A. P. PEABODY, Camp Verde, Ariz. Ter. The inventor provides a construction for a brake wherein the wearing shoe may be quickly and readily replaced; provides a holding device for securing the wearing shoe to the brake which will not become loosened; and provides a construction for securing the wearing shoe to the brake, which is strong, durable and simple.

**Vehicle-Wheel.**—L. INGLE and C. M. HART, Amityville, N. Y. By this invention the inner tube of an ordinary pneumatic tire may be eliminated and a substitute support the wheel and hold the outer casing in extended position. A plurality of cylinders and pistons within the tire are so mounted and disposed as to resist not only pressure radially of the wheel, but also side thrust or diagonal strain.

**SPRING-WHEEL.**—F. N. GIBB, Little Rock, Ark. The invention is especially useful in connection with automobiles, motor trucks, and the like. The wheel has resilient means for absorbing shocks from the irregularities of the road, and thus obviates the use of the pneumatic tire and the objections incident to such use.

**WIND-SHIELD.**—E. FLAGG, New York, N. Y. A wind shield constructed in accordance with this invention and formed of two sections, one of which is foldable to a position adjacent the other section, may rely solely upon the action of gravity to retain the movable section in either of its two positions, which is not ordinarily possible with a shield held in a vertical position.

**Vehicle-Wheel.**—D. L. PAISNER, Chelsea, Mass. One object here is to provide a vehicle wheel with two rims which are separated and held normally in their relative positions by springs and guides, which will not only permit the outer rim to move toward the inner rim and thus furnish the resiliency desired, but will also permit the outer rim to rotate slightly, relatively to the inner rim and thus furnish additional resiliency.

**STEERING MECHANISM.**—A. MAUKSCH, near Tabor, S. D. This mechanism can be used with the usual steering knuckles found on automobiles, so as to bring about a greater displacement of one of the two steering wheels than the other. The purpose of this is to displace the wheels so that their axes of rotation will intersect in the plane of one of the hind wheels. In this way the turning of the vehicle is made to take place about that hind wheel as a center.

**NOTE.**—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

## NEW BOOKS, ETC.

**DIE FLUGMASCHINEN.** Theorie und Praxis. Berechnung der Drachenflieger und Schraubenflieger. Von Georg Wellner, Maschineningenieur, Hofrat, Professor i. R. Mit 100 Abbildungen und 2 Tafeln. Vienna: A. Hartleben, 1909.

The author of this book has had about thirty years' experience in the solving of aerodynamic problems. As a general rule, aeronautical works are either entirely practical or purely theoretical; in other words, they either simply describe machines that have been actually constructed, or else set forth with the aid of complex mathematical formulae the theoretical problems involved in aerial flight. The book before us is unique in so far as it is a compromise. It is both a practical and a theoretical treatise. As to mathematics, the author has purposely avoided the usual analytical method of discussion, which provides for all contingencies and which considers not only uniform horizontal flight but accelerated flight and flight on an inclined plane, and has concerned himself chiefly with the synthesis of convenient and easily understood equations for those simpler cases of aerodynamics which agree fairly well with practice. Therefore, not a few mathematical formulae will be found in the book. Nevertheless, the work may be regarded as a semi-popular treatise. Approximations and abbreviations have been adopted perhaps too liberally, but inasmuch as the aim of the author seems to have been clearness of expression and a simple explanation of the principles of dynamic flying, his course seems to be justified. An excellent discussion of the relative merits of aeroplanes and helicopters or screw fliers will be found in the work. On the whole, the tone of the book is healthy. It is free from that exaggerated optimism which has led the public to expect more from the future of artificial flight than past failures would seem to justify.

**A HISTORY OF NEW YORK SHIPYARDS.** By John H. Morrison, author of "A History of American Steam Navigation." New York: William F. Sametz & Co. 8vo.; 165 pp.; 20 ill. Price, \$2 50 net.

The name of John H. Morrison as the author of anything connected with the history of shipping, particularly in New York city and vicinity, is a synonym of great accuracy and thoroughness of research; and these qualities are evident in the compact work before us. In his "History of American Steam Navigation" Mr. Morrison has given the public a very exhaustive summary of the ships built and their subsequent performances. Of equal value and interest is the story of the New York shipyards in which these vessels were built. It was only during the later history of colonial times that vessels began to be built in this city for the coastwise and the West Indian trade, and the material for the history of the shipbuilding of those days is very scanty. After the signing of the treaty of peace with Great Britain, the shipbuilding industry began to show indications of its subsequent great activity, which became pronounced after the monopoly of steam navigation on our rivers was removed in 1824. Then came the building of the ocean and coastwise steamships, and, later still, of the justly celebrated clipper ships. It was not until the close of the civil war that a marked decline began to occur in the shipbuilding of New York city. The work opens with a survey of the colonial period, followed by a chapter which carries the story to the year 1820 and contains an interesting account of the early American New York ships and shipbuilders, including the "Clermont" and its constructor, Charles Browne, who, by the way, was born in London, and served for some time in the British dockyards. Subsequent chapters deal with periods of large development in shipbuilding: the strikes of shipyard employees and the formation of trade unions; the famous "Mechanics' Bell," whose purpose it was to give regular notice when to commence and when to quit work; the new era of ocean steamships, which culminated in the magnificent clipper ships of worldwide fame; the launching of vessels and launching disasters; high water in wooden shipbuilding; a most interesting chapter containing new information about the yacht "America" and the records of prominent American clipper ships; and finally, a chapter on the decline of wooden shipbuilding. This is a most excellent work upon a too-much-neglected subject.

**INVENTIONS, PATENTS, AND DESIGNS, BY G. Croydon Marks. New York: D. Van Nostrand Company, 1909. 16mo.; 118 pp. Price, \$1.**

In this book Mr. Marks has printed in full the British Patents and Designs Acts of 1907, and has in connection therewith devoted many pages to a popular discussion of the questions which patent solicitors are continually required to answer. In this way much information is compiled in convenient form for reference.

**A GUIDE TO THE COUNTRY HOME.** By Edward Kneeland Parkinson. New York: The Outing Publishing Company, 1909. 12mo.; 156 pp. Price, \$1.

This well-printed little book deals with Choosing the Home; Winter Planning; Tools, Their Cost and Use; What Shall We Raise; Live Stock—the Horse; Cows, Their Cost and Care; Swine, the Curing of Hams and Bacon;

Fowls, Their Care, Cost, and Price; Crops and How to Plant Them; the Orchard; the Market Garden; the Kitchen Garden; Bees; Trees, Lawns, and Shrubbery, and the Harvest. The illustrations are printed on wood-cut paper and are inserted.

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## INDEX OF INVENTIONS

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Bale of cast metal, making hollow, A. Casner	935,741	Clamp, J. H. Umphrey	936,019	Harvester, B. Y. Gregg	936,121
Bank note tester, L. Cohen	936,030	Clasp, P. M. MacKaskie	935,949	Glass fastener, window, C. W. Phinney	936,158
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